

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-5001

During 1991, there were many significant events affecting Air Force packaging. As part of the reorganization of Headquarters Air Force Logistics Command, the Air Force Packaging Activity (AFPEA) was assigned to the newly formed Logistics Deputate. Also during the reorganization, the Packaging Policy Branch was reassigned to AFPEA from the former Packaging and Transportation Policy Division. This move united all the packaging functions in one organization and should result in greater synergism in Air Force packaging efforts.

AFPEA continued to provide a leadership role in the development and application of packaging engineering technology and in providing policy guidance and direction in packaging and hazardous materials management. A draft revision of AFR 71-4, Preparing Hazardous Materials for Military Air Shipments, was completed which incorporates the Performance Oriented Packaging (POP) requirements. During Desert Storm, AFPEA provided critical ultraviolet testing of films for use on F-15E canopies to reduce visibility problems caused by sand and dust abrasion. Progress was made on qualifying foam materials that do not contain the ozone damaging chlorofluorocarbons. A new latch and dessicant port were developed and elimination of the requirement to paint aluminum containers was initiated as part of the development of the Family of Munitions containers. A new spindle cutting system direct linked through fiber optic cable to a Computer Aided Design System (CADS) workstation is providing big production techniques in design and prototyping of containers.

AFPEA will continue to strive to provide quality cradle to grave packaging support to tomorrow's Air Force and DOD customers today.

PATRICIA A. HINNEBURG, Brig Gen, USAF
Deputy Chief of Staff/Logistics



COMBAT STRENGTH THROUGH LOGISTICS

AFLCP/AFMCP 71-7, 6 April 1992

DEPARTMENT OF THE AIR FORCE
Headquarters Air Force Logistics Command
Wright-Patterson AFB OH 45433-5001

AFLC PAMPHLET 71-7
6 April 1992

Headquarters Air Force Materiel Command
Wright-Patterson AFB OH 45433-5001

AFMC PAMPHLET 71-7
1 July 1992

ANNUAL REPORT 1991
AIR FORCE PACKAGING EVALUATION ACTIVITY

This pamphlet is developed to detail project accomplishments for the calendar year of 1991. Effective 1 July 1992 this pamphlet will become an Air Force Materiel Command (AFMC) pamphlet, and all references to AFLC will become AFMC.

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Supersedes AFLCP 71-7, 1 April 1991

No. of Printed Pages: 56

OPR: HQ AFLC/LGTP

Approved by: Col Arnold Kampe

Writer-Editor: Gloria Baker

Illustrator: Tony Jenkins

Distribution: X

AUL/LSE, Maxwell AFB AL 36112-5564.....1

HQ AFISC/IMP, Norton AFB CA 92409-7001.....1

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AFPEA MISSION

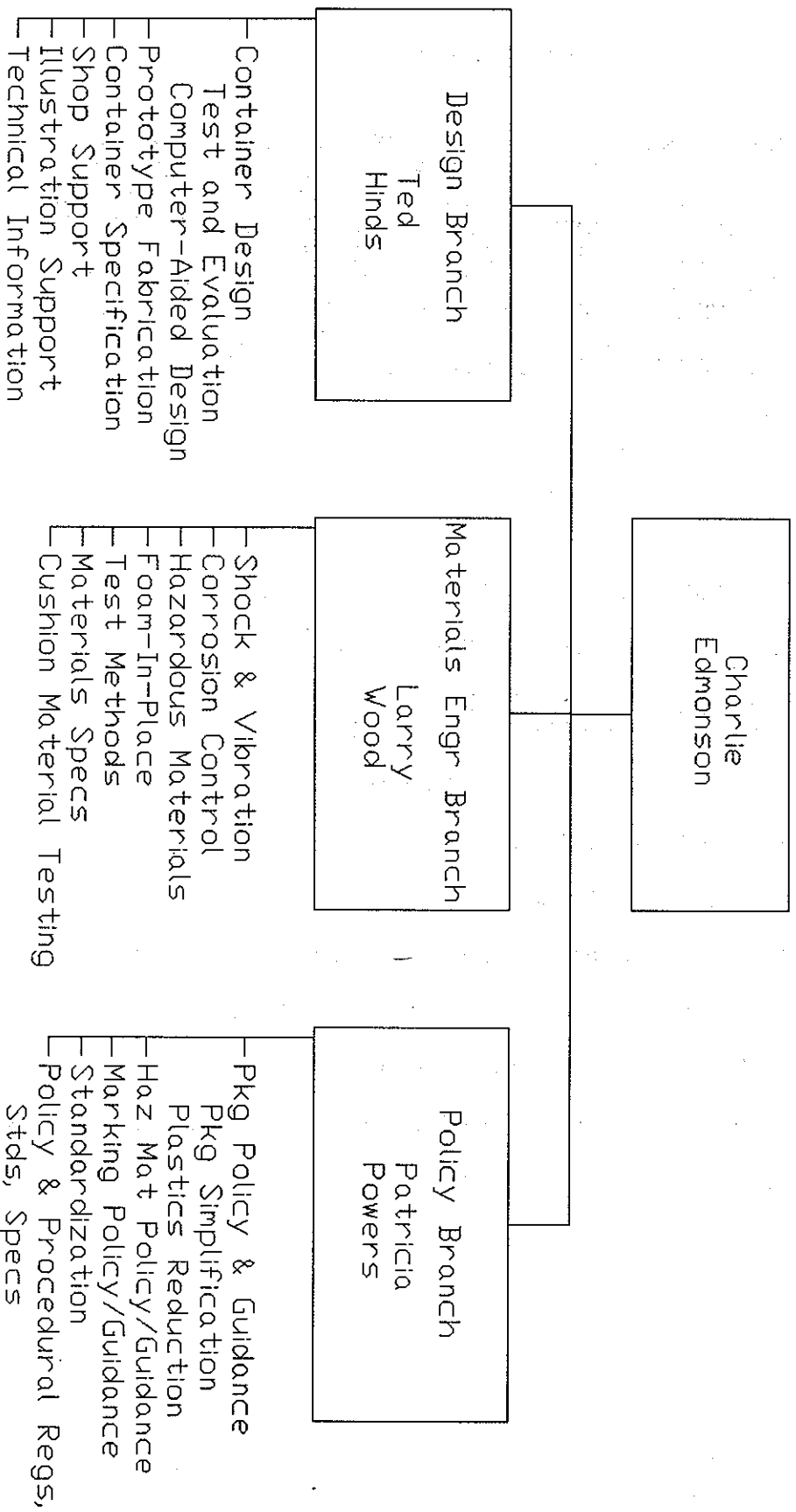
THE AIR FORCE PACKAGING EVALUATION ACTIVITY PROVIDES THE DEPARTMENT OF THE AIR FORCE WITH AN ENGINEERING CAPABILITY AND POLICY GUIDANCE AND DIRECTION ON PACKAGING AND HAZARDOUS MATERIALS AVAILABLE TO ALL MAJOR COMMANDS, OTHER DOD ACTIVITIES, AND CERTAIN OTHER FEDERAL AGENCIES. TO ASSURE DYNAMIC ENGINEERING AND TECHNICAL PROGRESS IN PACKAGING, THE AFPEA INVESTIGATES, DESIGNS, DEVELOPS, TESTS, AND EVALUATES CONTAINERS, MATERIALS, METHODS, AND TECHNIQUES.

THE ACTIVITY PROVIDES THE FOLLOWING SERVICES:

- CONTAINER DESIGN ENGINEERING
 - PROTOTYPING
 - DUMMY LOAD FABRICATION
 - STRUCTURAL MODELING AND ANALYSIS
- MATERIALS TESTING AND EVALUATION
- CORROSION CONTROL ENGINEERING
- STANDARDIZATION MANAGEMENT
- NEW PACKAGING CONCEPTS DEVELOPMENT/EVALUATION
- PACKAGING POLICY GUIDANCE AND DIRECTION
- HAZARDOUS MATERIALS MANAGEMENT
- COLLABORATION WITH GOVERNMENT/INDUSTRY ORGANIZATIONS
- LEAD SERVICE RESPONSIBILITIES

AIR FORCE PACKAGING EVALUATION ACTIVITY

(HQ AFLC/LGTP)



QUALITY INITIATIVES AT AFPEA

In July 1991, AFPEA initiated a quality effort by forming a quality steering team consisting of two members from each branch, one management representative and one administration representative. The steering team was formed to plan the overall division quality efforts.

The steering team plans Activity quality meetings. The Activity meets every two weeks for one hour to work on communication and coordination issues and quality training. The organization accomplished "What's Right, What's Wrong" analysis at AFPEA to determine what issues needed working on first and steps are being taken to correct them.

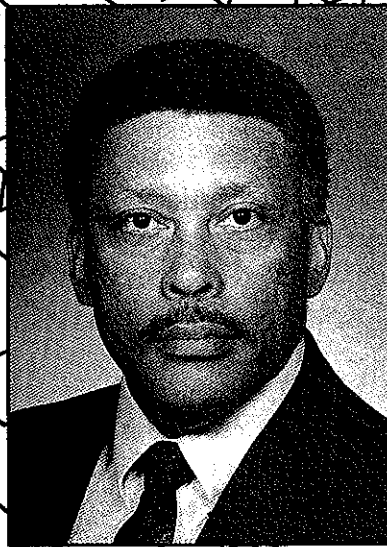
As a team building exercise AFPEA created their mascot to symbolize quality, Packaging is Great (PIG). Everyone was involved in development of Packy Pig and Pigtunia. Future endeavors at AFPEA include Departmental Task Analysis, Team-building Needs Analysis, and further work on "What's Right, What's Wrong" issues.



Team Members: Art Eggleton, Pat Powers, Susan Evans, Caroline Buckey
Gloria Baker, Don Vance, Joan Radcliffe, Floyd Wanke

DEPARTMENT OF THE AIR FORCE

AF PACKAGING EVALUATION ACTIVITY
AFMC/LGTP
WRIGHT PATTERSON AFB OHIO 45433



CHARLIE P. EDMONSON
CHIEF

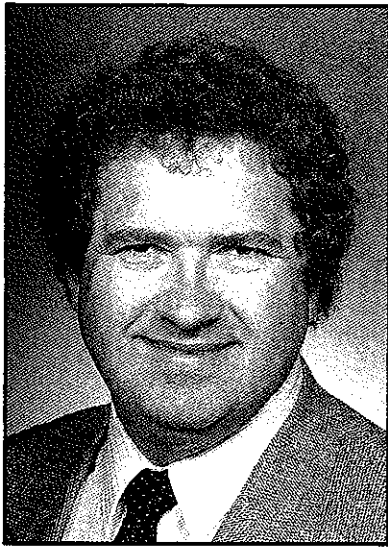


GLORIA BAKER
STAFF ASSISTANT

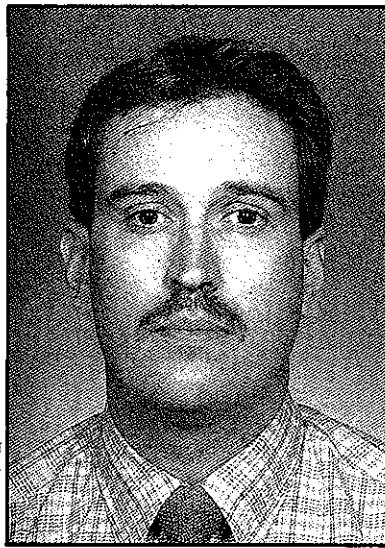


ANGELINE RUNCO
SECRETARY

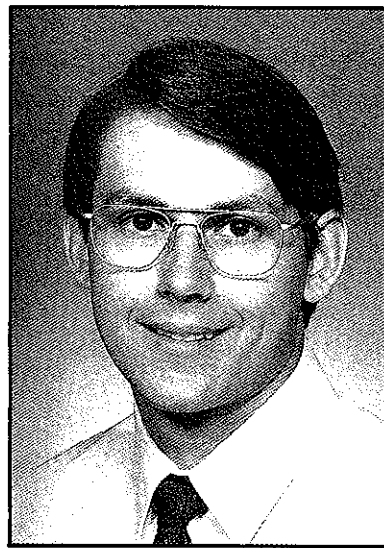
DESIGN ENGINEERING BRANCH



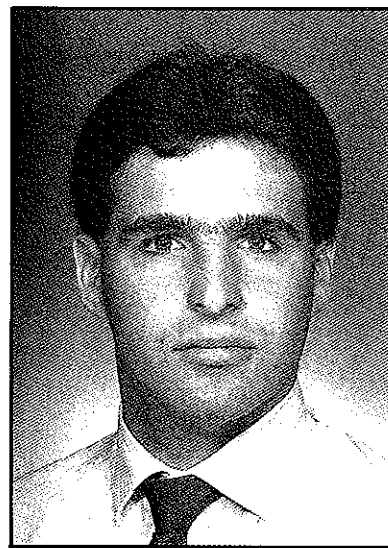
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CAREY GRAVENSTINE
COMPUTER ENGR



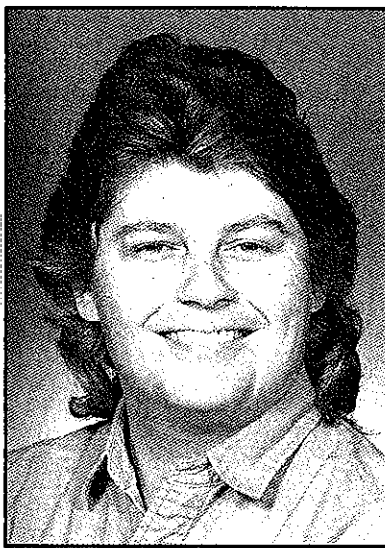
FLOYD WANKE
MECHANICAL ENGR



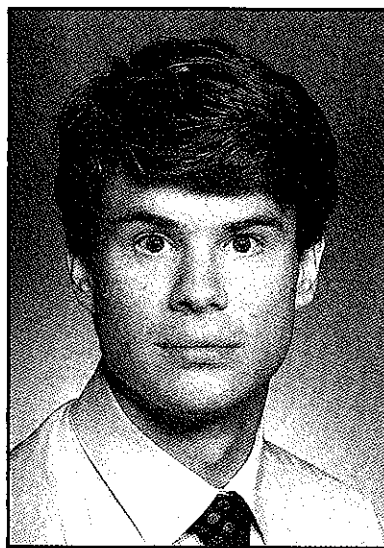
BOB TEKESKY
MECHANICAL ENGR



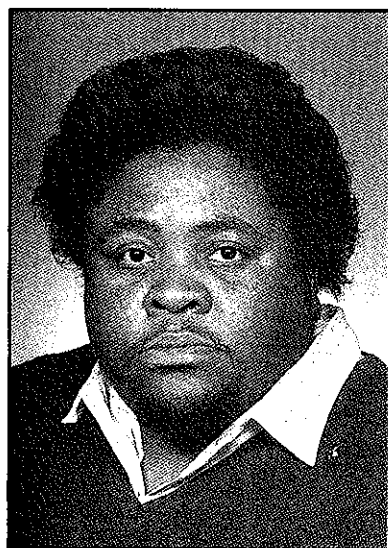
STACIE SMITH
MECHANICAL ENGR



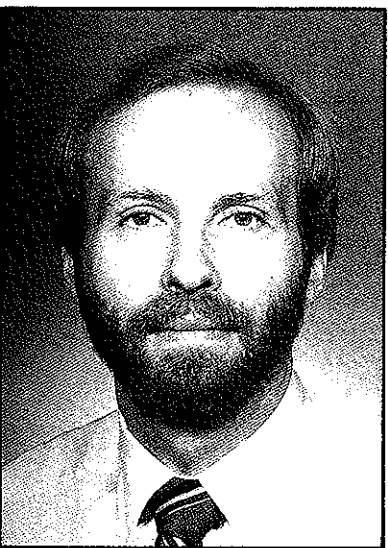
ROBBIN MILLER
MECHANICAL ENGR



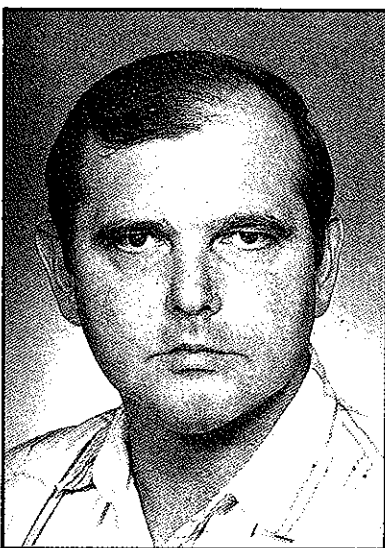
RON DeLUGA
MECHANICAL ENGR



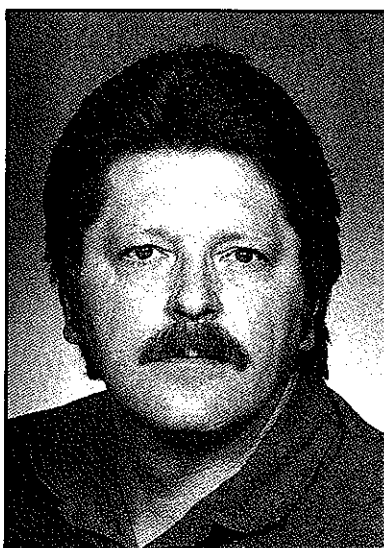
TONY JENKINS
ILLUSTRATOR



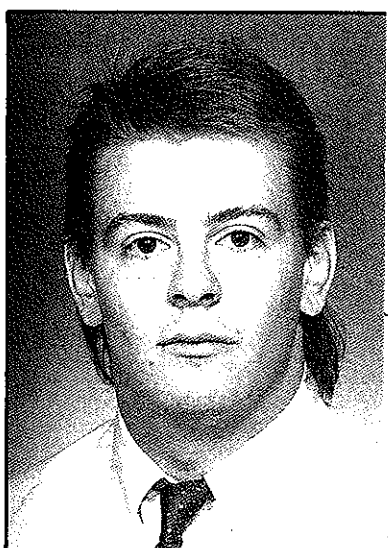
JAMES STEIGER
MECHANICAL ENGR



LARRY HATTER
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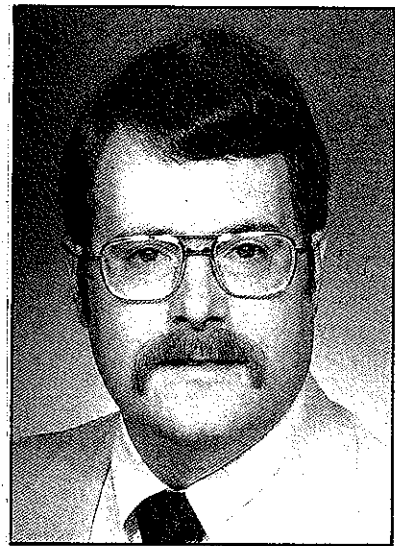


DON VANCE
SHOP/TEST SUP.

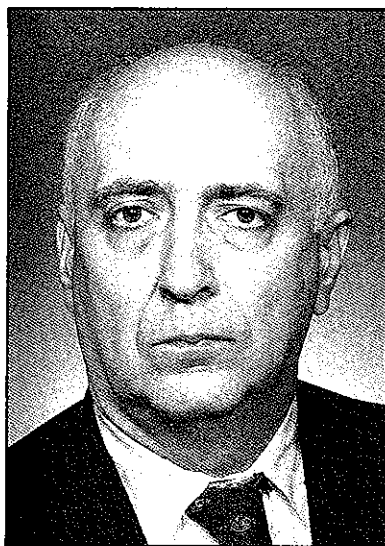


JASON GILREATH
CO-OP ENGR

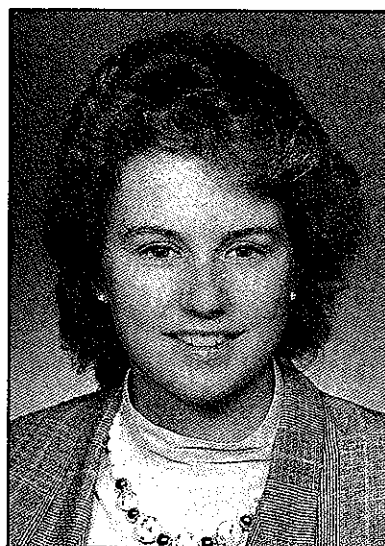
MATERIALS ENGR BRANCH



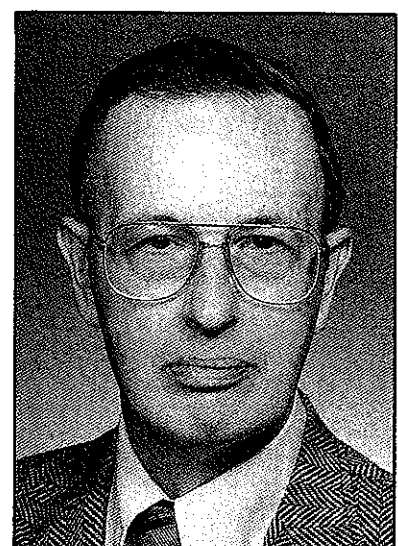
LARRY WOOD
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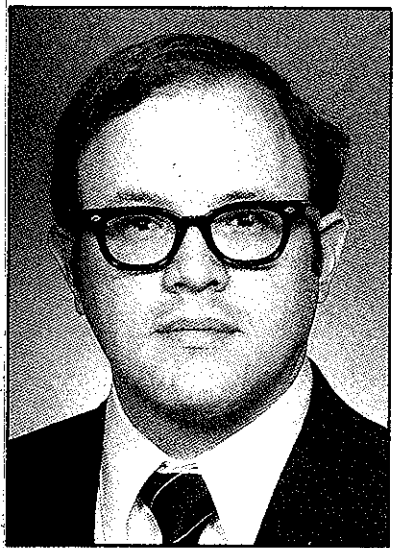
EDWARD MORAVEC
PHYSICIST



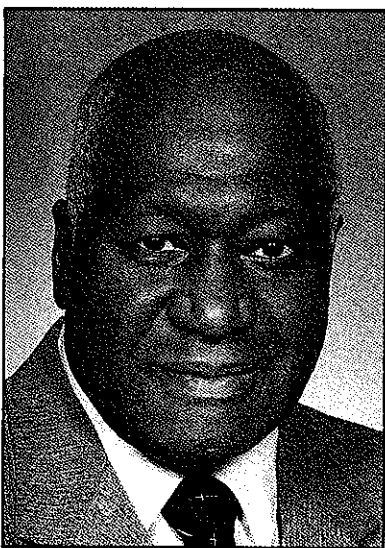
CAROLINE BUCKEY
MECHANICAL ENGR



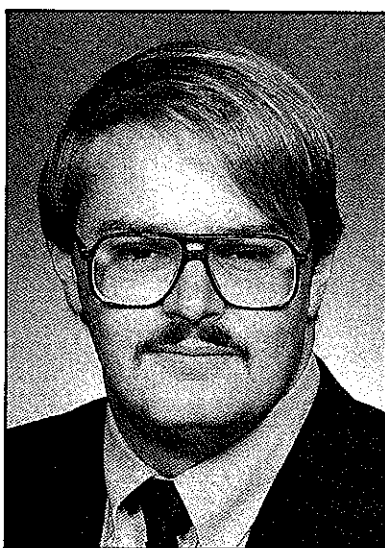
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KEITH VOSSLER
MECHANICAL ENGR



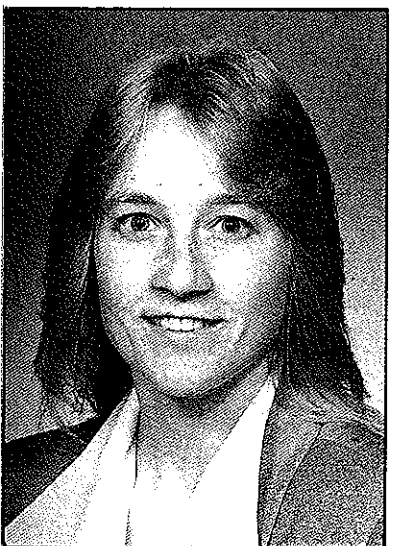
AVERY WATSON
MATERIALS ENGR



WARREN ASSINK
MATERIALS ENGR



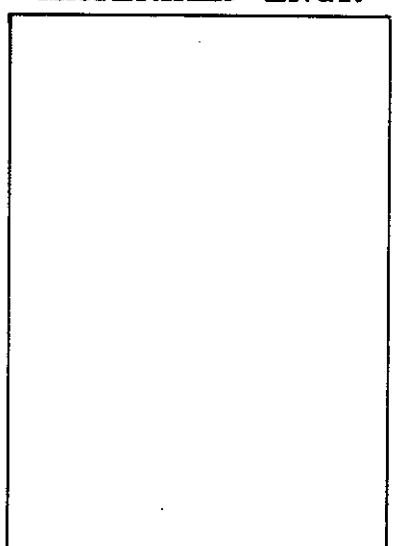
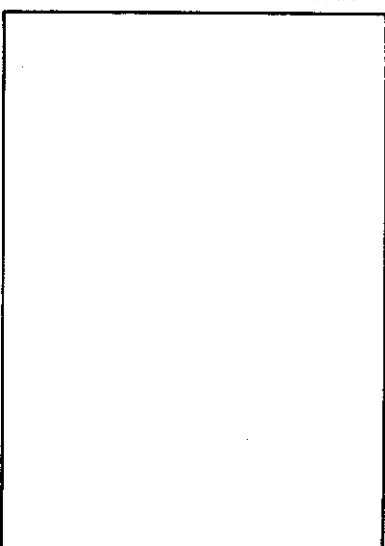
SUSAN EVANS
MATERIALS ENGR



SUSAN MISRA
MATERIALS ENGR



BARBARA TAYLOR
STANDARDS/SUPPLY





PATRICIA POWERS
CHIEF

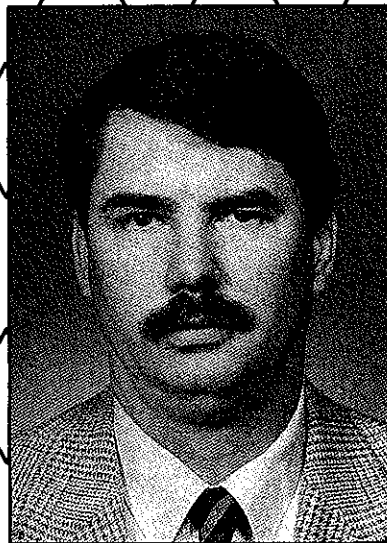
POLICY BRANCH



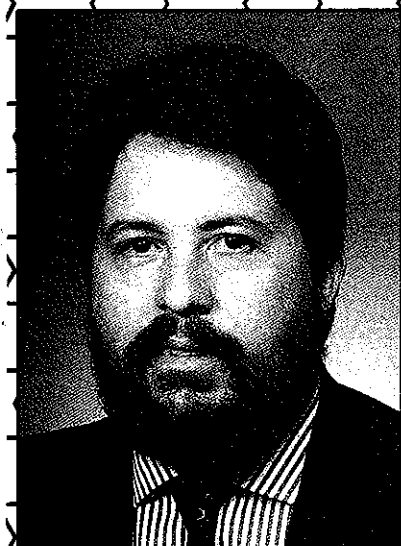
JOAN RADCLIFFE
PACKAGING SPEC



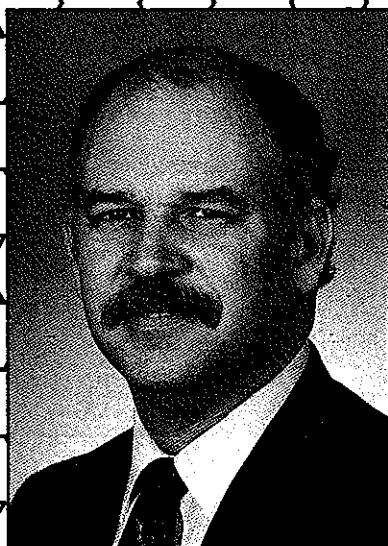
LIZ SMITH
PACKAGING SPEC



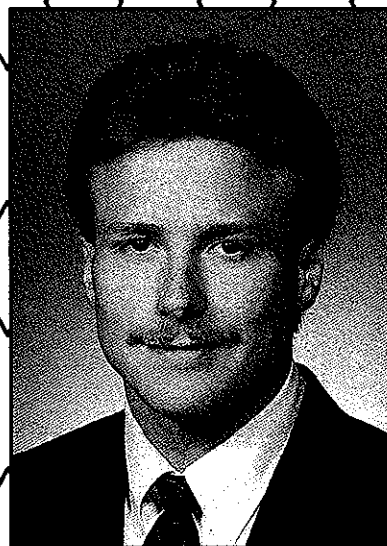
MIKE WERNEKE
PACKAGING SPEC



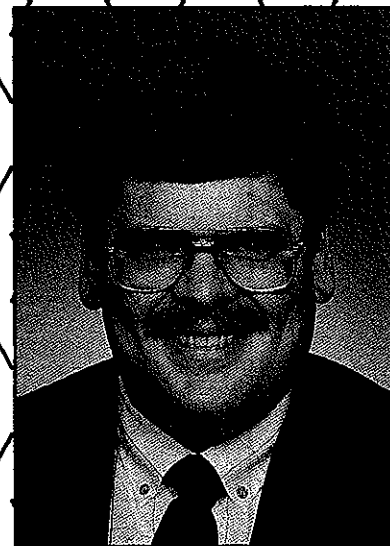
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AFR 71-4

The Air Force Packaging Evaluation Activity (AFPEA) completely revised AFR 71-4, Preparing Hazardous Materials for Military Air Shipments, and submitted a draft of the revision to field activities for their comments and recommendations. This joint regulation is the policy document that covers all shipments of hazardous materials transported by military aircraft. The draft revision of AFR 71-4 incorporates the new Performance Oriented Packaging (POP) requirements. POP identifies test requirements that containers must be tested to before they can be used for the shipment of hazardous materials. The completed document is expected to be published in FY92.

HQ AFLC/LGTPP, Michael Werneke, DSN 787-4503

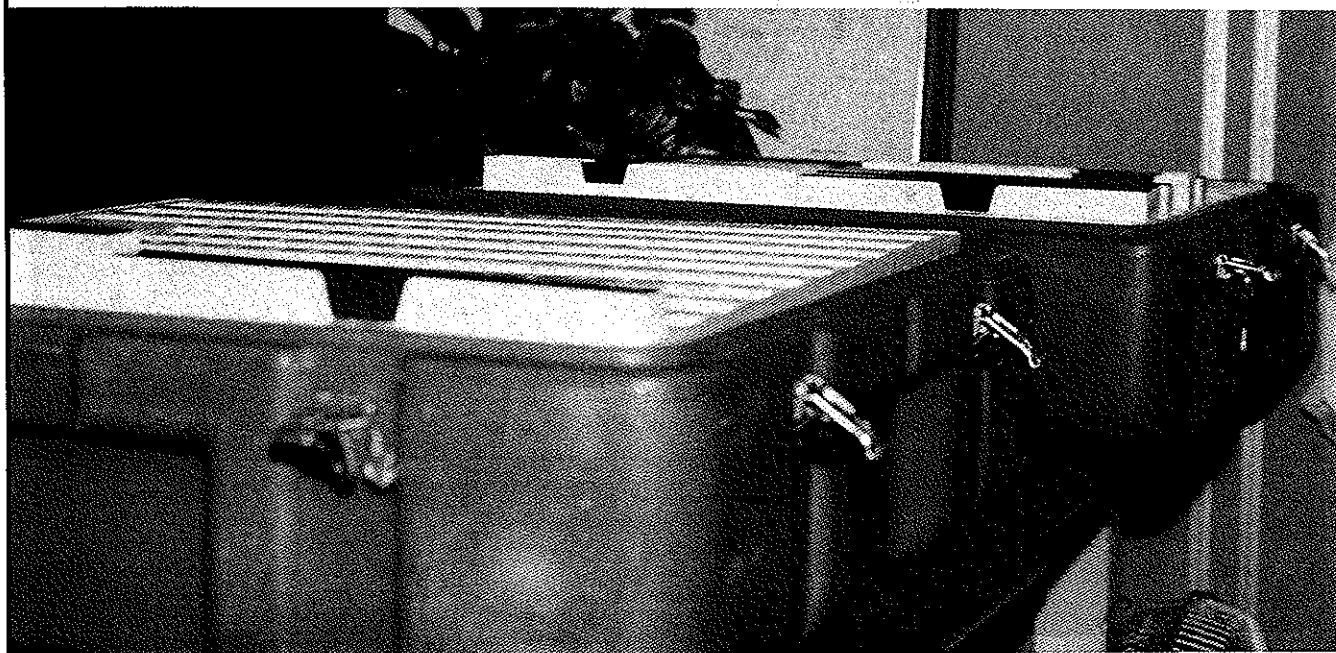


Mail Out of Draft

AFRTS VIDEOCASSETTE TAPE CONTAINER PRODUCTION EVALUATION

At the Armed Forces Radio and Television Service (AFRTS) request in 1990, AFPEA evaluated the container inserts for the AFRTS videocassette tape containers. AFPEA recommended a new material for the inserts. In 1991, AFRTS sent AFPEA pre-production material samples for verification of a vendor. AFPEA gave a technical evaluation. The vendor then manufactured and sent AFPEA a first-article insert. AFPEA approved the insert and production started. After 200 units had been manufactured and shipped, the user realized that the tapes did not fit properly. AFRTS again requested AFPEA to evaluate the problem. AFPEA determined that the production dimensions varied greatly compared to the first-article dimensions. The final determination was that the production tolerances needed to be held more tightly. AFRTS's contracting office used this information to correct the problem and production resumed.

HQ AFLC/LGTPM, Caroline J. Buckey, DSN 787-4519

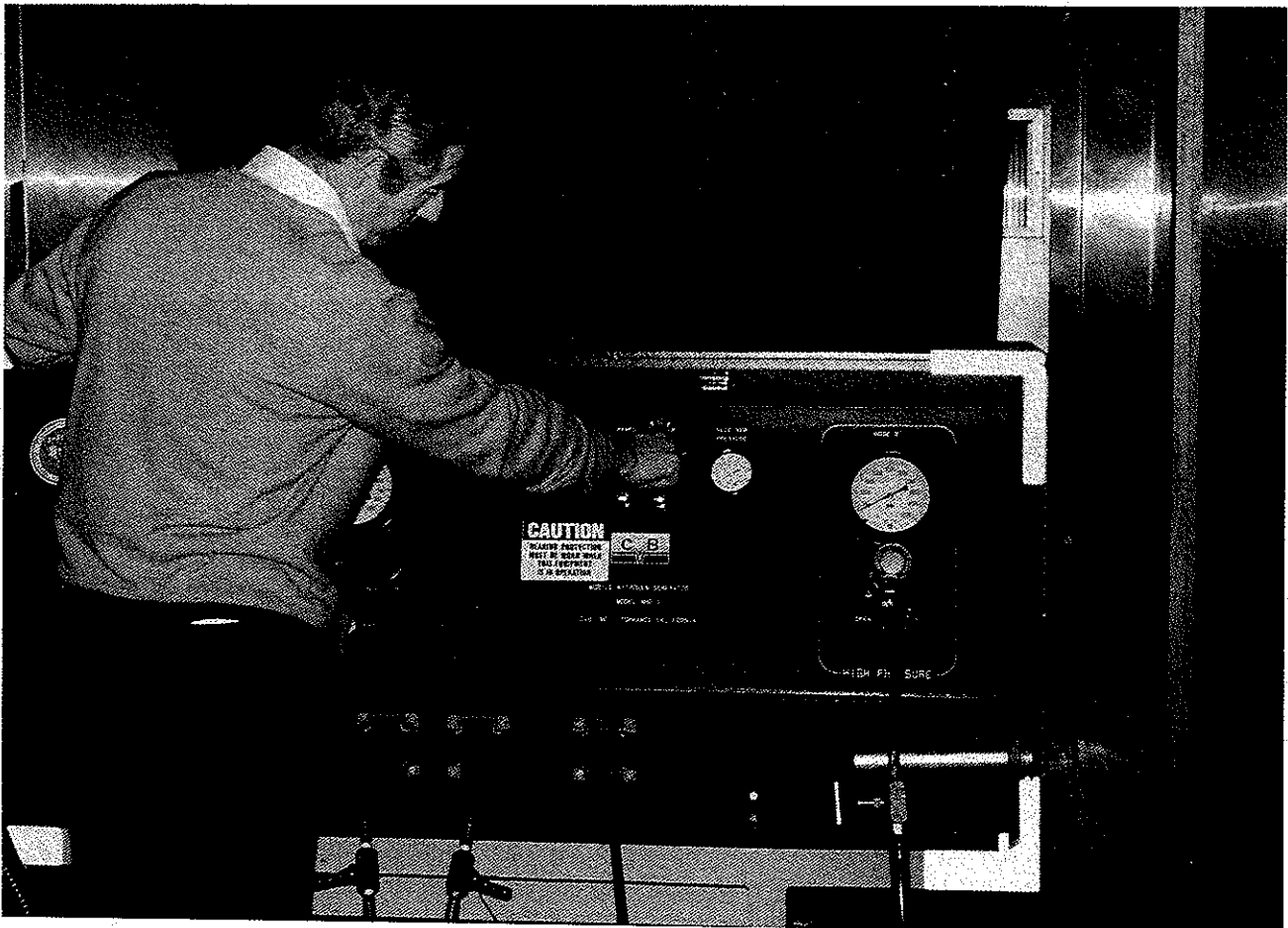


Comparison of Production Prototype Videocassette Tape Containers

SELF GENERATING NITROGEN SERVICING CART (SGNSC) TESTING

AFPEA assisted the PRAM office in performing cold weather start and operational testing of three different Self Generating Nitrogen Servicing Carts (SGNSC's). The units cold soaked at -25°F in AFPEA's large walk-in cold chamber. Attempts were then made to start the SGNSC's. Only one SGNSC was able to start, but it was unable to produce nitrogen at an acceptable rate at -25°F . This testing was very valuable to the PRAM office as well as to the SGNSC manufacturers.

HQ AFLC/LGTPD, Floyd Wanke, DSN 787-3362



Start Up of CVB Self Generating Nitrogen Servicing Cart

AIR FORCE SUPPORT OF DEFENSE PACKAGING POLICY GROUP (DPPG)

The Defense Packaging Policy Group (DPPG-formerly Joint Packaging Coordinating Group) is a group of DOD packaging policy managers. Their concerns primarily involve application of new packaging concepts, standardization among the services/DLA, packaging training, increased productivity, and cost effectiveness of military packaging. LGTPP was the Chair/Executive Secretary of the DPPG for the last two years.

DPPG efforts undertaken in 1991 include rewrite of the DPPG Charter to include policy-making authority; Total Quality Management Training for DPPG members; Rebuttal of Senate Staffer "findings" on "wasteful packaging practices in the DOD;" Oversight of GAO survey on "wasteful packaging practices in the DOD;" Packaging Lessons Learned reporting from Desert Shield/ Desert Storm; Performance Oriented Packaging updates/issues since the Jan 91 implementation date; plastics reduction/ environmental issues relating to packaging; and establishment of metrics implementation guidelines. In addition, the DPPG worked toward implementation of their Military Packaging Simplification Study initiatives. As a result of their efforts, the DPPG was awarded one of the 1991 Defense Standardization Awards. LGTPP is proud to be the Air Force representative to this proactive DOD group.

HQ AFLC/LGTPP, Patricia Powers, DSN 787-4503



VEHICLE TIRE LIFE EXTENDED

Following Desert Storm, AFPEA prepared a detailed process specification for the topical (brushing and dipping) application of the MIL-P-11520F rubber preservative. This document is based on successful test results conducted by the US Army, USAF and the USMC.

Age Master #1 is the trade name of this preservative. It is manufactured by Chem-Pro Manufacturing Company, Inc., Buffalo, New York 14221. Though there is no Qualified Products List (QPL), it is the only topical application material that has been approved for increasing the life of vehicle tires.

A high percentage of DOD vehicle tires have to be replaced due to degradation (cracking, aging and dry-rot) resulting from ozone attack, ultraviolet rays and/or long-term storage periods and conditions. This penetrating preservative doubles the environmental exposure life of vulcanized and synthetic rubber products.

The preparing activity for MIL-P-11520F is US Army Tank Automotive Command, Warren, Michigan 48397. Age Master #1 can be procured through the GSA, Federal Supply Service, Engineering Division, Auburn, Washington 98001.

HQ AFLC/LGTPM, Avery Watson, DSN 787-4519

STANDARD DESICCANT PORT WITH TABS

During the Preliminary Design Review of the Family of Munitions Containers we showed the users a new standard desiccant port made out of stainless steel. The users liked the fact that it will not corrode like the cadmium plated desiccant ports; but they asked if we could get one with tabs on the side to aid in opening and closing the port.

We worked with the manufacturers and came up with a stainless steel desiccant port with three tabs on it. This was presented to the users at the Critical Design Review for the Family of Munitions Containers. The users stated that this satisfied all their needs.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362



POLICY SUPPORT DURING OPERATION DESERT STORM

The Packaging Policy Branch (LGTPP) provided policy support to ensure hazardous materials (including munitions) were properly packaged and shipped to field activities during Desert Storm. The primary policy document for the shipment of hazardous materials by military air is joint service regulation AFR 71-4, Preparing Hazardous Materials for Military Air Shipments. LGTPP is OPR for this regulation. Policy requirements contained in AFR 71-4 worked extremely well, with only nine Air Force waivers being issued during the entire operation. Most of the waivers were issued to airlift hazardous materials that were packed in containers used for surface movement only.

LGTPP was also instrumental in assisting the Office of the Assistant Secretary of Defense in issuing a waiver to the newly implemented Performance Oriented Packaging (POP) requirements. POP requires hazardous materials containers to be tested. If the container passes, it can be used to ship hazardous materials. At the start of Desert Storm, DOD was still testing containers to the POP requirements and without this waiver (worked with each country), DOD would not have been able to support their field activities.

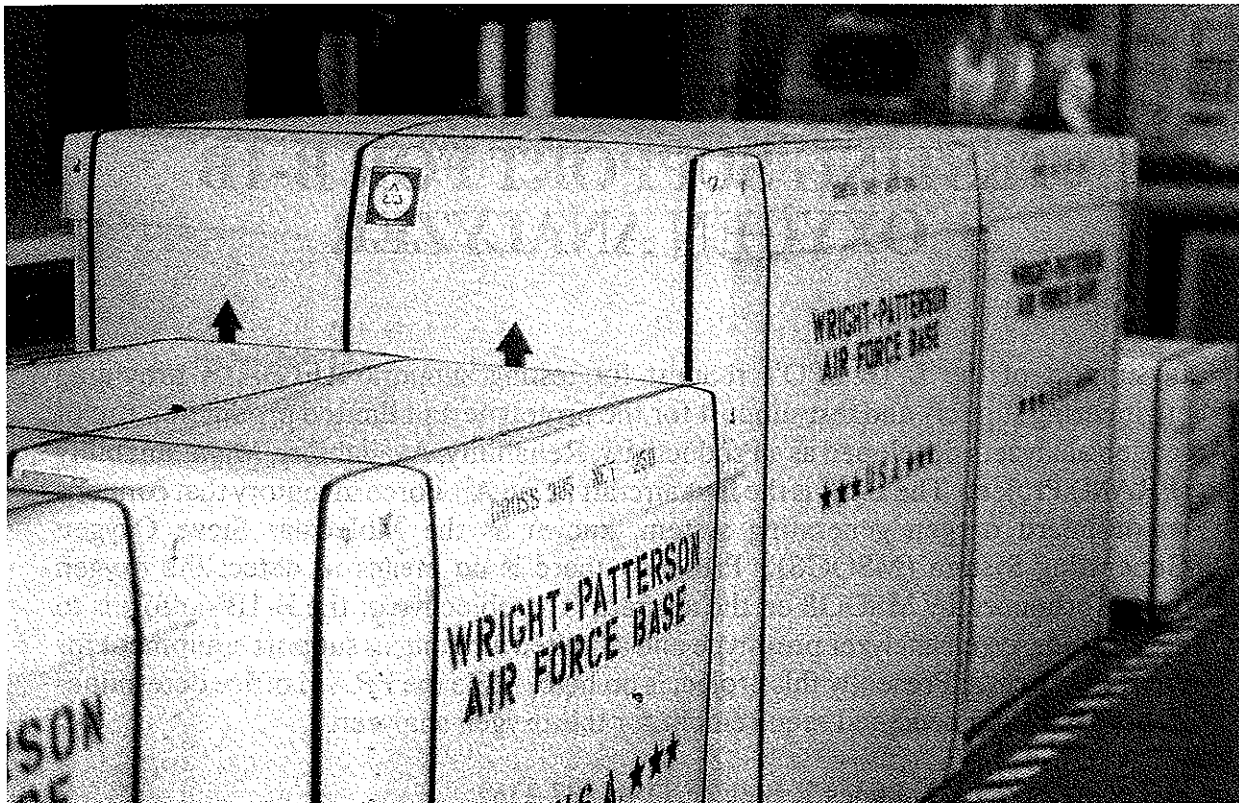
With the possible threat of chemical warfare during Desert Storm, LGTPP developed packaging policy and procedures for shipping chemically contaminated cargo. This policy would have enabled field activities to return chemically contaminated repairable assets to repair sites. Prior to this, there was no policy/procedures on shipping chemically contaminated cargo.

HQ AFLC/LGTPP, Michael Werneke, DSN 787-4503

EVALUATION OF CORRUGATED PLASTIC CONTAINERS

At the recommendation of Oklahoma City Air Logistics Center (OC-ALC), AFPEA is conducting an evaluation of a new concept, heavy corrugated high-density polyethylene material as an alternative to cleated-plywood PPP-B-601 containers. The container concept is similar in design to the corrugated fiberboard containers identified in PPP-B-636 or PPP-B-640. If the material passes testing and evaluation, there could be significant savings in weight and labor costs. Other factors, such as material availability and life-cycle costs, will also have to be evaluated. In FY92, AFPEA will be testing actual configurations, examining its applicability in DOD, and investigating the possibility of incorporating the plastic corrugated container into a specification.

HQ AFLC/LGTPM, Caroline J. Buckey, DSN 787-4519



Pack-Lite Containers Ready for Testing

COLD TEMPERATURE TESTING SUPPORT FOR F-117

In support of the 4950th Test Wing's request for immediate help, AFPEA made its Low Temperature Chamber available for testing on 24 hours notice. The 4950th Test Wing fabricated an experimental set of Inlet Covers for the F-117 aircraft. However, during cold temperature (-40 F) testing at Eglin AFB, Florida, several of the covers failed. A redesign and fabrication effort was accomplished on a smaller, less expensive test article which would identify any potential problems. Items of the original design and the redesign were placed in the Low Temperature Chamber at -65 F. The following day the 4950th Test Wing engineers inspected and tested the pieces. The redesign proved to be successful.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362

TESTING SUPPORT FOR B-1B OXYGEN ANALYZER

In support of the B-1B SPO's request for testing support, AFPEA is providing engineering support and test support for the prototype and limited production run of oxygen analyzers developed as a Productivity, Reliability, Availability, Maintainability (PRAM) Project. The B-1B is the first aircraft in the Air Force inventory that contains an on-board oxygen generating system, known as the Molecular Sieve Oxygen Generating System (MSOGS). Presently there is no means to detect the oxygen output produced by MSOGS on the aircraft. The objective of the B-1B's effort is to develop an oxygen analyzer prototype and a limited amount, as support equipment for the B-1B aircraft. Presently this project is on hold, while the PRAM office determines if there is a valid need and requirement for this oxygen analyzer.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362

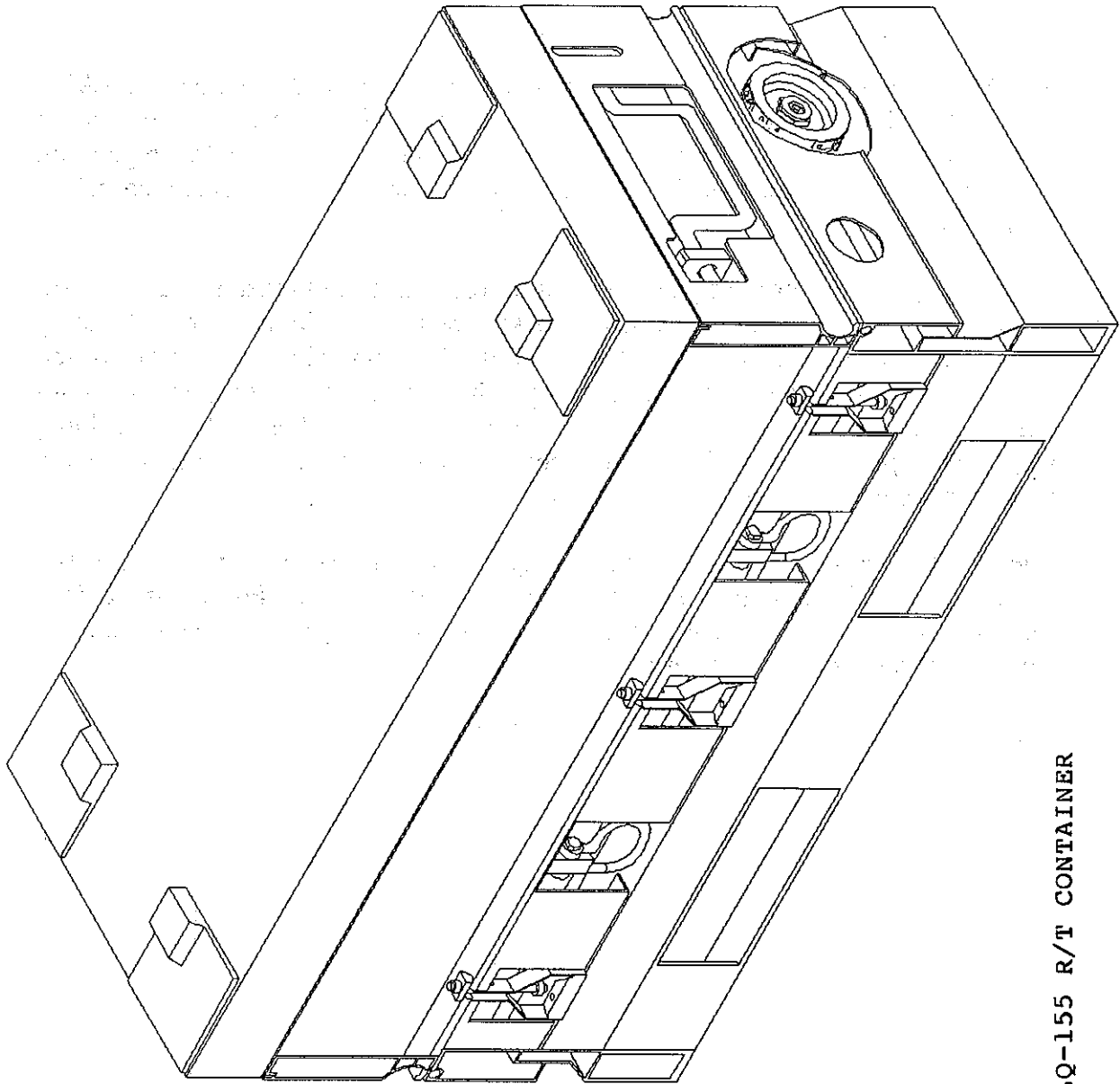
REVISION OF AIR FORCE PACKAGING REGULATION AFR 71-9

The AFR 71-9 was published in Nov 91 with a 3 Oct 91 revision date (supersedes AFR 71-9, 3 Dec 80). This regulation prescribes the policy and procedures for preservation and packing Air Force materiel at Air Force activities. In addition, this regulation provides directions on establishing and maintaining an effective reusable container program.

Reusable containers are designed to be used, reclaimed, and reused as a complete system. Many items can be returned to serviceable condition after undergoing reclamation, repair, or retrofitting. This function often cannot be accomplished by the base, requiring the item be returned to a repair facility. By utilizing reusable containers, bases can ensure that the item will sustain no further damage, avoiding additional repair, labor and/or material cost. By reclaiming and reusing packaging materials, we can also reduce material costs.

The reusable container and reclamation programs have the capacity of decreasing the Air Force overall packaging expenses. For FY91, the five Air Force Air Logistic Centers alone documented \$9.3 million dollars in savings by reusing and reclaiming containers and cushioning materials.

HQ AFLC/LGTPP, Jose G. Orsini, DSN 787-4503



ALQ-155 R/T CONTAINER

ALQ-155 RECEIVER-TRANSMITTER CONTAINER

Headquarters Strategic Air Command requested engineering assistance from the Air Force Packaging Evaluation Activity (AFPEA) in March 1991 with the requirement for a category I container to house the ALQ-155 Receiver-Transmitter during world wide shipping and storage. PRAM project 22091-01 was approved 18 September 1991 for AFPEA to design, prototype and test a long-life, reusable, environmentally sealed, aluminum container.

The container, internal dimension of 1100.0mmL x 370.0mmW x 428.0mmH, will be constructed out of double wall aluminum extrusions with sheet aluminum for the cover cap and base floor. Two major requirements of the users were to improve handling (packing/unpacking) of the unit and containment of the damping fluid the unit leaks. The short (327.0 mm) base extrusion incorporates a one piece base/skid design and allows easy removal and placement of the 200 pound R/T unit. The sealed container completely contains the damping fluid the R/T unit leaks during transportation. The container incorporates a desiccant port, humidity indicator, pressure/vacuum relief valve, air filling valve and quick release latches. The quick release latches and user friendly container/cushion system design allows the users to pack/unpack the unit within three minutes with no loose packing material.

A Preliminary Design Review was held 16 October 1991 with the users and the container design met all requirements. A Critical Design Review will be held early April 1992. The project is scheduled for completion in July 1992.

HQ AFLC/LGTPD, Robbin Miller, DSN 787-3362

F-15 DESERT STORM SUPPORT

During operations Desert Shield/Desert Storm, AFPEA provided critical testing of films proposed for use on F-15E canopies to reduce visibility problems caused by sand and dust abrasion. Airborne sand and dust has a detrimental effect on the windshields of all aircraft, but this "sand blasting" was directly affecting the aircrew visibility associated with the F-15. The F-15 System Program Office (SPO) was taking action to ensure that this problem did not affect F-15E readiness and operability.

The initial solution was the very labor intensive mechanical buffing with equipment and materials supplied by McDonnell Aircraft. The F-15 SPO preferred the use of transparent abrasion resistant films to the outer surfaces of the windshields. As part of the SPO's evaluation program, various transparency samples required exposure to ultraviolet (UV) light and humidity to simulate the deterioration in transparent plastics caused by sunlight and water (rain and dew). The manufacturers of the films could not conduct the tests. AFPEA provided a timely solution. The required 336 hour tests were conducted in the recently acquired Atlas Ultraviolet/Condensation Screening Device at AFPEA. The tests were satisfactory. Panels then were transported to a government facility for accelerated abrasion testing in a wind tunnel. Following the equally successful wind tunnel tests, films were applied to F-15 canopies for flight testing.

HQ AFLC/LGTPM, Avery Watson, DSN 787-4519

AIR FORCE SUPPORT OF NAVY PLASTIC REMOVAL IN MARINE ENVIRONMENT (PRIME)

Public Law 100-200 mandates the reduction of plastics aboard Navy vessels in order to eliminate additional contamination of the marine environment. In order to comply with this requirement the Navy, in collaboration with all DOD services/ agencies, has commenced the PRIME initiative. One of the goals of this project is to reduce or eliminate plastic packaging materials on assets used by the Navy, while maintaining the same level of protection as when plastics were used.

While the Packaging Policy Branch's main objective in participating in the PRIME initiative is to assist the Navy in complying with public law; we anticipate an Air Force wide use of the technology gathered in support of PRIME, to comply with future legislations that may ban plastics from landfills. The main challenge we face is that packaging material must withstand the rigors of exposure to the environment in order to adequately protect the asset. Currently, plastics not only offer the required protection, but also have versatility and cost advantages over suitable substitute materials.

In addition to new technology under the PRIME initiative, we will continue to expand current Air Force reusable container/reclamation program as a viable option to reduce plastic disposal.

HQ AFLC/LGTPP, Jose G. Orsini, DSN 787-4503

EVALUATION OF COATING MATERIALS FOR AMARC

AFPEA recently completed a comparative evaluation test of wood preservation coatings for Aircraft Maintenance and Regeneration Center (AMARC). Currently, only one brand of coating is used to protect wood containers from heat, ultraviolet light, and water damage in outdoor storage. The AMARC contracting office wanted to find at least one other brand of coating which would work as well as the current brand to allow for competition and avoid using a sole source. Samples of three coatings were sent to AFPEA and tested in accordance with specification ASTM D55 using an Atlas UVCON Ultraviolet/Condensation Screening Device. As a result of testing, one of the brands was found to be unacceptable because of blistering; however, the other two brands performed acceptably. AMARC will consider these test results along with other characteristics, such as tendency to run and drying time, to determine the acceptability of possible alternative coatings during competitive bidding.

HQ AFLC/LGTPM, Susan Evans, DSN 787-4519

25MM AMMUNITION LOADING SYSTEM (ALS) TECHNICAL SUPPORT

Technical assistance had been requested from ASD/ALXP to have AFPEA assist the AC130U Gunship SPO in evaluating the proposed Ammunition Loading System (ALS) container. This is a contractor designed container for 25mm ammunition which interfaces with the 25mm autoloader. Ammunition is automatically fed from the container, located on a trailer outside the aircraft, to the 25mm "gatling" gun which is located on the AC130U Gunship. The gun's "magazine" holds 3000 rounds of ammunition.

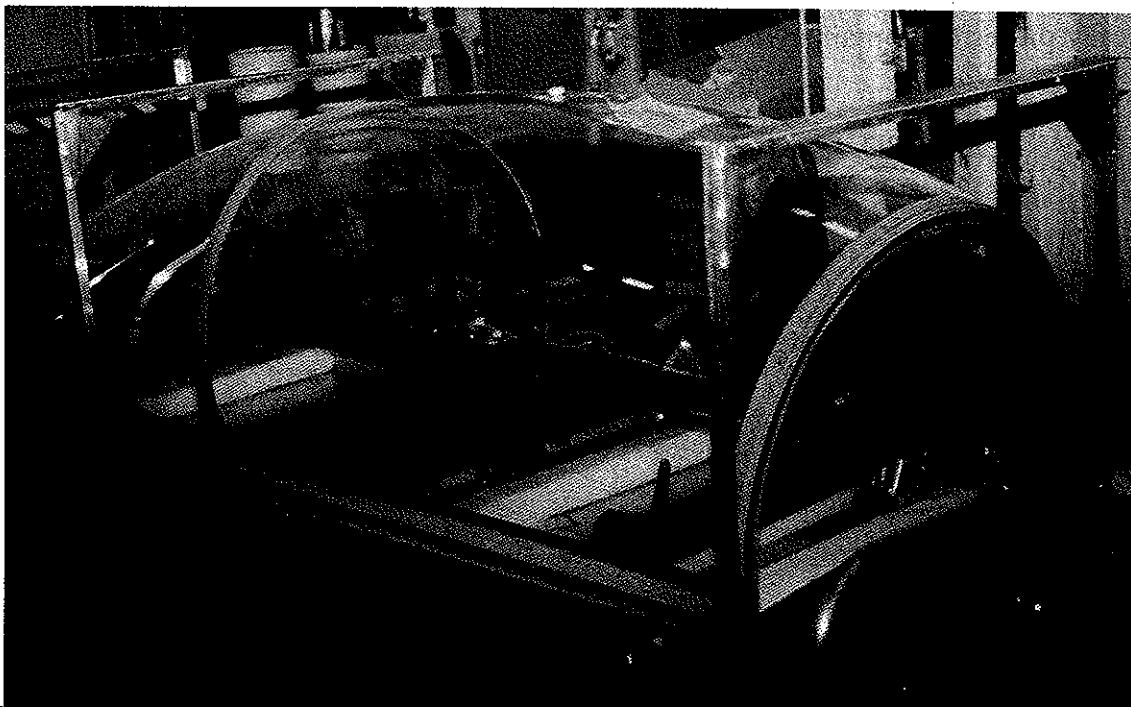
AFPEA has attended various Technical Interchange Meetings (TIMs) and the Preliminary Design Review (PDR). The contractor has been pushing for a "Cor-Ten" steel container similar to the GAU-8 30mm container (CNU 332), but sealed. AFPEA had the users/AFSOC/SPO look into and consider various options in the container design; such as the container height and ammunition capacity, 1000, 2000 and 3000 round capacities (one, two, or three compartment configurations) in order to arrive at a design which is user friendly, safe, and meets the users objectives. We assisted in writing the container specification. We have also performed a life-cycle cost analysis comparing various containers. A final determination has not yet been made as to the construction of the container, "Cor-Ten" steel vs. aluminum. The economic analysis showed that the unpainted aluminum container was the economically preferred container to use. The estimated completion date for this project is August 1992.

HQ AFLC/LGTPD, Floyd Wanke, DSN 787-3362

F-15 ONE AND TWO MAN CANOPY CONTAINER

Warner Robins Air Logistics Center (WR-ALC), the depot maintenance activity for the F-15, identified a problem with the one and two man canopies in Jul 91. The canopies were elongating and deforming in their wooden shipping/storage containers. Once this deformation occurs, the canopy glass must be scrapped and replaced with a new glass at a cost of approximately \$13,000. WR-ALC requested the Air Force Packaging Evaluation Activity (AFPEA) to design an aluminum, sealed container that would ship/store either the one or two man canopy. Through user input, AFPEA incorporated a handling fixture into the container design. The current handling frame cost approximately \$7,000 each. AFPEA accepted the project and was able to develop a container design along with a removable handling frame for the canopies within a six month time frame. The container is designed from double walled aluminum extrusions and aluminum sheet. The outside dimensions are 12'L x 4'W x 4'H. The container will be stackable up to 16' high and have quick release latches, desiccant port, humidity indicator, pressure relief valve, air filling valve and hoisting rings. A prototype has been fabricated and will be tested during the month of January. The container should be out on contract to manufacture by the first quarter of FY93.

HQ AFLC/LGTPD, Robert Tekesky and Robbin Miller, DSN 787-3362



PACKAGING POLICY VIDEO "PACKAGING OF THE 90s"

LGTPP prepared a short animated "clay-mation" video to illustrate changes the DOD Packaging community can expect in the coming decade. The film has been shown to various DOD and industry groups as an educational device.

"Packaging of the 90s" is broken into three segments - Simplification, Conversion to International Standards (metrics and Performance Oriented Packaging (POP)), and Environmental Awareness. The film was created and produced in its entirety using the talents/resources available in the Packaging Policy Branch.

HQ AFLC/LGTPP, Patricia Powers, DSN 787-4503

AFLC PACKAGING MATERIAL COST RATIOS

The Packaging Policy Branch conducted an evaluation of AFLCP 173-10, Packaging-to-Weight Cost Ratio. Because this ratio only considered the weight of the asset, packaging cost projections did not factor-in the assets fragility, size, and/or classification (reparable or consumable). The initial analysis showed that fragility, not weight, is the principal factor driving the cost of packaging an asset.

In order to address the above issues, the Packaging Policy Branch, conducted studies using Air Logistic Centers actual packing costs and packing cost incurred during the closure of Pease AFB. From these studies, three ratio categories (1) Bare Items Reparable; (2) Bare Items, Consumable; (3) Unitization, Palletization, Containerization of Packaged Assets (Reparable and Consumable) were developed. In addition to this initial segregation, the reparable and consumable classifications were subdivided into MIL-STD-2073 fragility groups, each with its own cost ratios. Results:

I. Bare Items Reparable:

<u>Fragility</u>	<u>Cost Per Cubic Foot</u>
0-14 Gs	\$21.80
15-24Gs	17.25
25-39 Gs	7.47
40-59 Gs	6.03
60-84 Gs	5.04
85-110 Gs	4.12
Over 110 Gs	2.70

II. Bare Items Consumable:

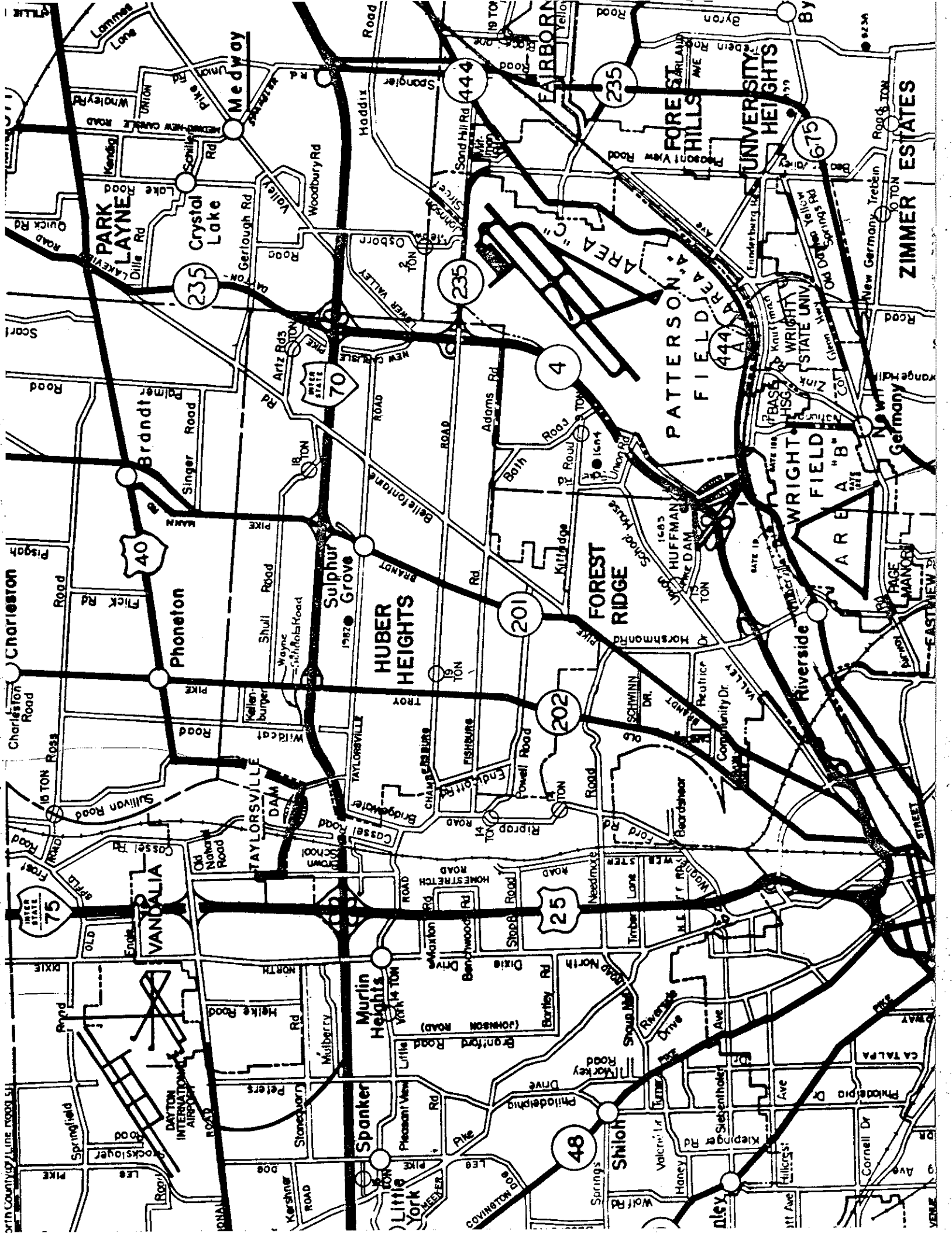
<u>Fragility</u>	<u>Cost Per Cubic Foot</u>
85-110 Gs	\$1.33

III. Unitization, Palletization, Containerization of Packaged Assets:

<u>Fragility</u>	<u>Cost Per Cubic Foot</u>
All	\$0.33

Above ratios are applicable to depot or base level packaging cost and should not be used to project cost of long-life metal or composite material containers.

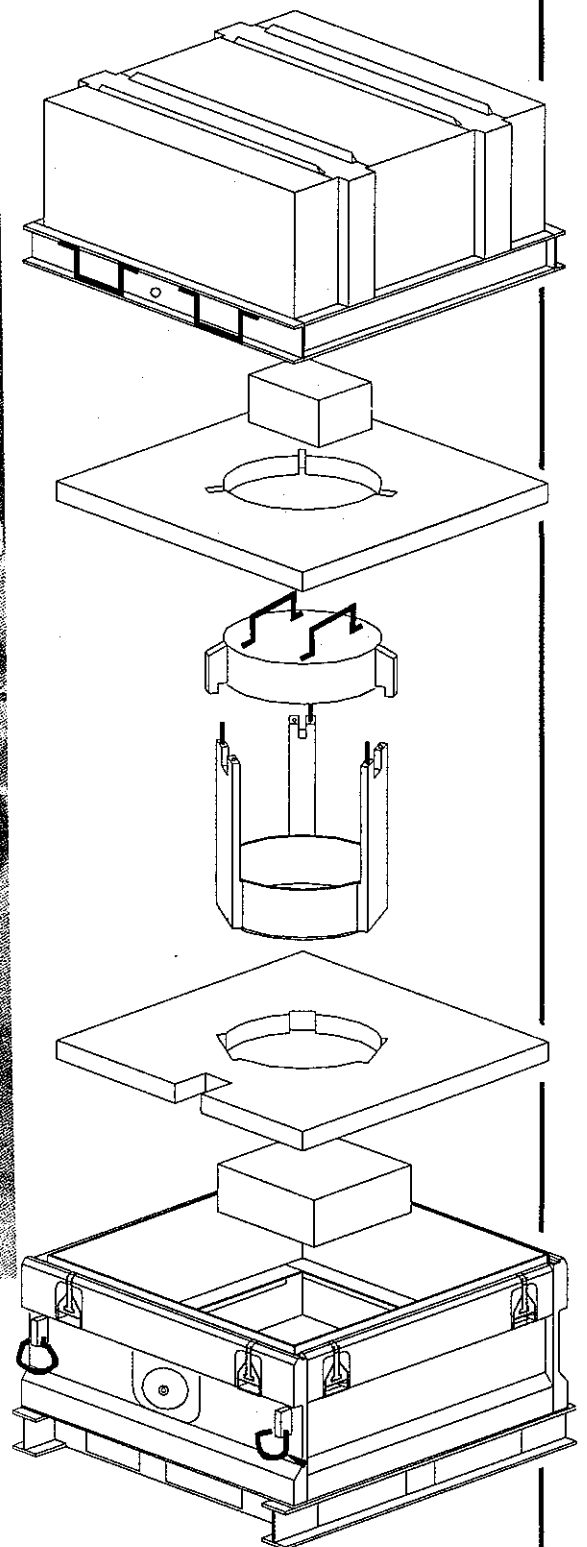
HQ AFLC/LGTPP, Jose G. Orsini, DSN 787-4503



SMAW AND HAVE NAP MISSILE CONTAINER TESTS

AFPEA was tasked by MSD/YJA, Eglin AFB, Florida, to perform test and evaluation for the Shoulder Mounted Attack Weapon (SMAW) rocket container, CNU-490/E and to provide test support for the HAVE NAP missile container, CNU-496/E. Both containers are of the controlled breathing desiccated type and are fabricated by welding from aluminum extrusions. Both containers provide shock and vibration protection to their respective contents. For both containers, the test series included leak test, vibration test, stacking test, and high and low temperature drop test as well as tests specific to a particular container. The test series and evaluation for the CNU-480/E were performed at AFPEA and are available in Report # 91-R-01. The CNU-496/E test was performed at the Redstone Technical Test Center, Redstone Arsenal, Alabama.

HQ AFLC/LGTPM, Edward Moravec, DSN 787-4519



COMBAT TALON II CONTAINER

The Air Force Packaging Evaluation Activity (AFPEA) is providing engineering support to the Combat Talon II (CTII) program office in the design, manufacturing, and management of worldwide shipping and storage containers for ten CTII items. CTII is a modified C-130 aircraft providing added protection to cargo and personnel by terrain following, enemy avoidance, and weather guidance. Over the past year, AFPEA supported the CTII SPO by modifying two ku-band antenna containers, two x-band antenna containers, one nose radome container, and three of the four AFPEA Infrared Detection Set (IDS) containers for first site activation of the MC-130H aircraft in August. Second site activation is set for March 1992. The CTII SPO will require ten each of the ku-band and x-band antenna containers. AFPEA will provide engineering support to the SPO when the contract to modify the containers is awarded.

Level III drawings for the modification to the x-band and ku-band antenna containers are complete along with the IDS container drawings. The contract to build 34 IDS containers and modify 15 each of the x-band and ku-band antenna containers will be awarded in 1992.

AFPEA and the SPO explored the possibility of replacing the current aluminum nose radome container design with an ISU-90 bare base container manufactured by Brooks and Perkins. However, no decision has been made. The SPO is investigating other possibilities, also.

HQ AFLC/LGTP, Stacie Smith, DSN 787-3362

COMBAT TALON II LINE REPLACEABLE UNITS (LRU) CONTAINERS

A sealing and stacking problem was identified in the LRU plastic containers. AFPEA has been working closely with the manufacturer to correct the problems. Presently, the plastic containers do not meet Mil-C-4150 stacking requirements. The plastic containers were subjected to a simulated 16 foot stack test under high humidity and high temperature conditions. The containers passed the initial pressure test of 0.5 psid, bowed excessively while under the stacking test, and did not pass the final pressure test. AFPEA then reduced the stack test to one on top of another and the containers did not pass the tests, either. Presently AFPEA and the manufacturer are pursuing modifying the containers with side stiffeners and a different gasket.

AFPEA suggests that all plastic containers that are procured for government and/or military use be subjected to qualification testing to reverify that the containers are in accordance with Mil-C-4150 requirements, mainly the sealing and stacking requirements. We also recommend that all contracts or purchase orders state that the containers being procured shall meet Mil-C-4150 requirements. Failure to recognize that these containers do not always meet our requirements could result in damage to end items.

HQ AFLC/LGTPD, Stacie Smith, DSN 787-3362

TRANSPORTABLE COLLECTIVE PROTECTION SYSTEM CONTAINER TESTING AND DESIGN

Human Systems Division (HSD/YAGD), Wright-Patterson AFB, Ohio requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) in conducting shock and vibration testing on the modified Transportable Collective Protection System (TCPS) Rowley Stand-Alone container.

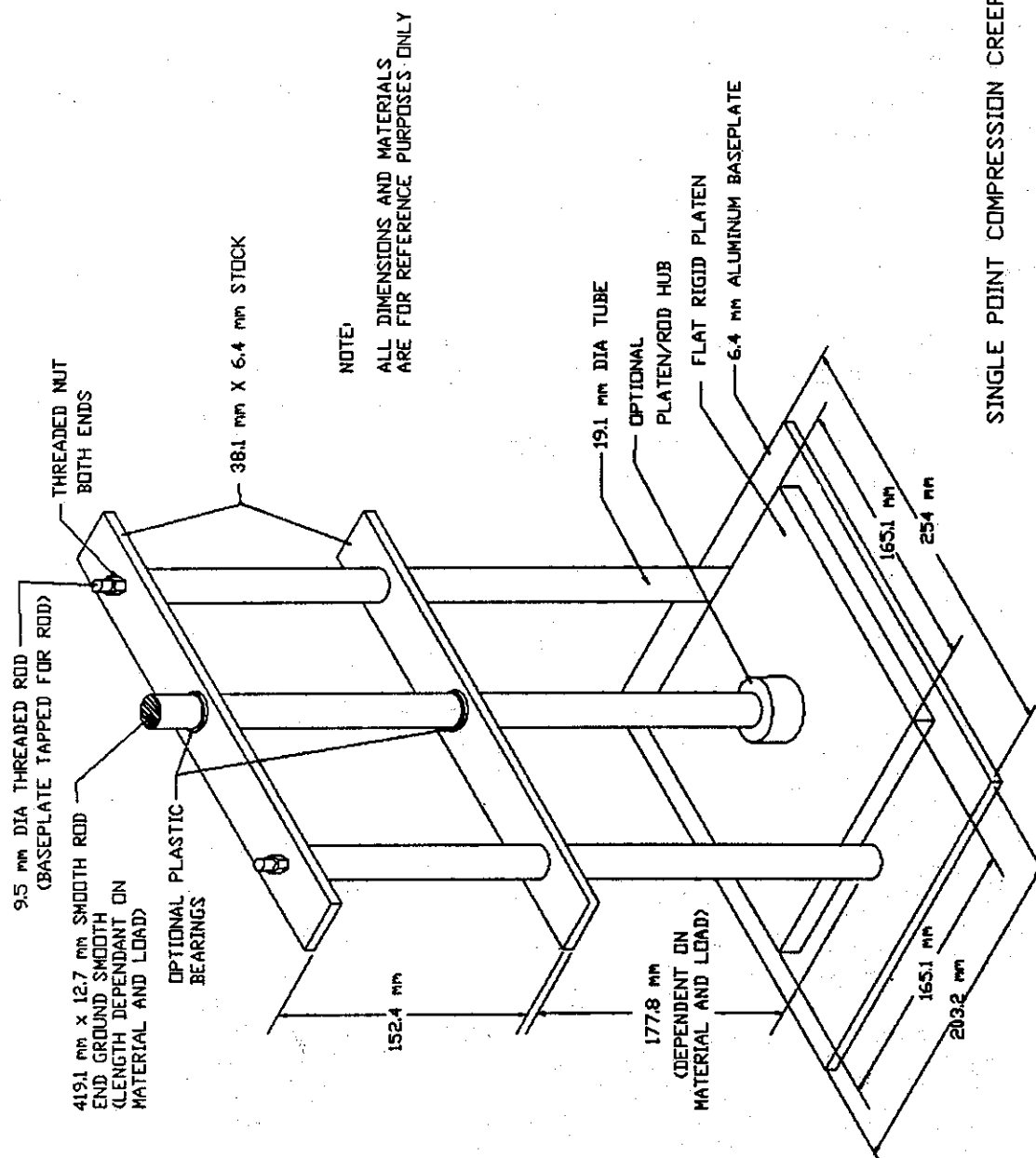
The TCPS, manufactured by ILC/Dover Inc., is a chemical warfare tent. Personnel can enter the tent, remove protective clothing, and perform duties in an uncontaminated environment.

Previous vibration tests resulted in pole and container damage. HSD/YAGD requested AFPEA to design and prototype the support rack and retest the new design to ensure that the TCPS and its container would not be damaged by shipment and handling. Upon completion of testing, the modified support racks passed all tests and met all HSD/YAGD requirements. The results of this project are available from AFPEA in Report #91-R-04.

HQ AFLC/LGTPM, Caroline J. Buckey, DSN 787-4519



Final TCPS Container Design Showing Poles and Rack Support



SINGLE POINT COMPRESSION CREEP FIXTURE

ASTM COMMITTEE D-10 ON PACKAGING

AFPEA is represented on the American Society For Testing and Materials (ASTM), D-10 Packaging Committee. The scope of this committee is the promotion of knowledge and the development of standards for packages. Standards include definition of terms, classifications (including dimensions), recommended practices, test methods, and specifications. This work also includes defining or generating closely related packaging design criteria and developing related material handling standards.

AFPEA has been active in Task Group D10.13 which is updating D2221 - Standard Test Method for Creep Properties of Package Cushioning Materials. In addition to updating the specification, the Task Group has developed a Single Point Compression Creep Fixture. AFPEA's version of this fixture is shown.

AFPEA will participate in laboratory testing to compare the Single Point Fixture test results with the Static Load Box Creep Fixture currently in use. If test results between the two test fixtures are compatible and test results between laboratories agree, the Single Point Fixture will become part of the test method.

HQ AFLC/LGTPM, Keith A. Vossler, DSN 787-4519



FAMILY OF MUNITIONS CONTAINERS

FAMILY OF MUNITIONS CONTAINERS

Ogden Air Logistics Center, Air Munitions Program Management Division (OO-ALC/MMW), requested engineering assistance on their PRAM Project OO-237. The idea of a Family of Munitions Containers came from an OO-ALC/MM Process Action Team (PAT), headed by OO-ALC/MMW. This PRAM Project was approved 18 September 1989 and actually started 18 October 1989. It is scheduled for completion in early summer 1992. The goal of the project is to replace the more than 200 current munitions containers the Air Force presently uses with a family of four to six containers. The exterior of the container would stay the same but the interior dunnage would change depending on the item placed in the container. We have completed a Preliminary Design Review and a Critical Design Review (CDR) for the three smallest containers. At the CDR we had prototypes of these containers available for the users to see and touch. OO-ALC/LIWDT, formally MMW, the PRAM Project Manager, put the two largest containers on hold. We are designing, prototyping, and testing the containers; and providing other engineering support as needed. Following are descriptions of the three smallest containers.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362

FAMILY OF MUNITIONS CONTAINERS PROJECT CONTAINER #1

Container #1 is the smallest of the family of munitions containers. It has inside dimensions of 12"L X 8"W X 9"D and an empty weight of approximately 15 pounds. This is a sealed container with pressure/vacuum relief and air filling valve. The sealing gasket is located in the cast aluminum lid. The container body is a two piece double wall aluminum extrusion made from a single extrusion die. The container is designed to hold up to 35 pounds of small explosives and munition items, but testing will be accomplished to determine if the 35 pounds of contents may be increased to 50 pounds.

The necessary extrusions, casting, latches, etc. were procured this past year. The container was also prototyped by our shop this past year. Environmental, rough handling, and UN (POP) testing should be completed by March 1992.

HQ AFLC/LGTPD, Floyd Wanke, DSN 787-3362

FAMILY OF MUNITIONS CONTAINER #2

The Family of Munitions Container #2 is a small, sealed, generic, multi-use, two-person carrying container. The container will be used to carry fuzes, boosters, etc. for a maximum gross weight of 150 pounds. The containers internal dimensions are 516mm x 416mm x 356mm (20" x 16" x 14") and a tare weight of 55 pounds. The container is constructed out of two aluminum extrusions and sheet aluminum for the top and bottom. The container will have a cam-over-center aluminum extruded latch, desiccant port, pressure relief valve, humidity indicator, and air filling valve. Stacking pads will be located on top of the container for easy lock-in-place stacking. Palletized loads will be made easier with this container's stackability. The containers external finish will be bare aluminum. This will cut cost in painting and maintaining the container. Life cycle of this container will be 20 years.

HQ AFLC/LGTPD, Robert Tekesky, DSN 787-3362

FAMILY OF MUNITIONS CONTAINER #3

The Family of Munitions Container #3 is a medium sized, sealed container. It is being designed specifically for the BSU 49, BSU 50, and MSU 650 fins. The container will be manufactured exclusively from aluminum with internal dimensions of 1244 mm X 965 mm X 838 mm (49" X 38" X 33").

The major feature of this container is its short base, only 203 mm (8") of internal height. This short base allows for easy removal and preparation of the fins. The fins will be stored just the opposite of the current method. The aft end of the fins will be placed in the base of the container. This allows the open end of the fin to be ready accessible to the user to prepare them for usage. The bottom aluminum extrusion includes the base and the skid of the container. This single extrusion greatly simplifies the manufacture of the container. Standard latches, pressure/vacuum relief valves, air filling valves, and tie down rings will be used. Instead of being painted the container will be left bare. This will greatly reduce the long term maintenance costs and environmental impact. With bare aluminum the stenciling can be applied using the standard stenciling ink, A-A-208.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362

PROGRESS ON CFC-FREE CUSHIONING FOAMS

The international community, as well as the US Government, is planning to reduce the use of chlorofluorocarbons (CFCs) to zero by the year 2000. In addition, Air Force Regulation 19-15 addresses the need to ban the use of CFC foams as soon as CFC-free foams become available.

This action is taking place in response to data which demonstrates that the atmospheric conditions caused by these chemicals deplete the earth's protective stratospheric ozone layer. Stratospheric ozone depletion is predicted to have a significant adverse global impact on human health, climate, and natural environmental systems. By April 1991, further data revealed the ozone situation to be twice as bad as was believed in 1990, according to Air Force Regulation 19-15.

As the lead activity for prefoamed and foam-in-place foams, AFPEA is responsible for providing the technical support and engineering assistance on cushioning foams to all DOD organizations. In compliance with DOD directive 6050.9, "Established Policy and Procedures for Reducing the Use of CFCs and Related Chemicals", AFPEA developed a strategy to qualify CFC-free cushioning foams from commercial suppliers:

Step 1 - Conduct a literature search and analysis to get the latest policy on CFCs from the DOD and obtain information on cushioning foams, processes, foam processing equipment, and testing methods.

Step 2 - Collect CFC-free samples from suppliers and conduct material evaluations to identify foams which have performances equal or better than that of CFC blown foams.

Step 3 - Approve new foams for military procurement and revise military specification requirements to cope with the new CFC-free foam properties.

Today, AFPEA is at Step 3. The following results have been achieved:

MIL-F-83671, Foam-In-Place (3 Classes)

Class 1 - A rigid CFC-free foam has been approved for military procurement.

Class 2 - A flexible CFC-free foam has been approved for military procurement.

Class 3 - A semi-rigid CFC-free foam has been approved for military procurement.

MIL-P-26514F, Prefoamed

Type I - A standard CFC-free foam (Grades B and C) have been approved for military procurement.

Type III - An anti-static foam has been approved for military procurement.

In addition, AFPEA (in an effort to encourage development and implementation of CFC-free foams) is in the process of issuing a revision which revises the Hydrolytic Stability test procedure such that conformance to the CFC-free goal is obtainable. Also, AFPEA has included in the revision a recommendation against procurement of any material which has an adverse environmental impact.

HQ AFLC/LGTPM, Susan J. Misra, DSN 787-4519

PERFORMANCE ORIENTED PACKAGING (POP) OF HAZARDOUS MATERIALS

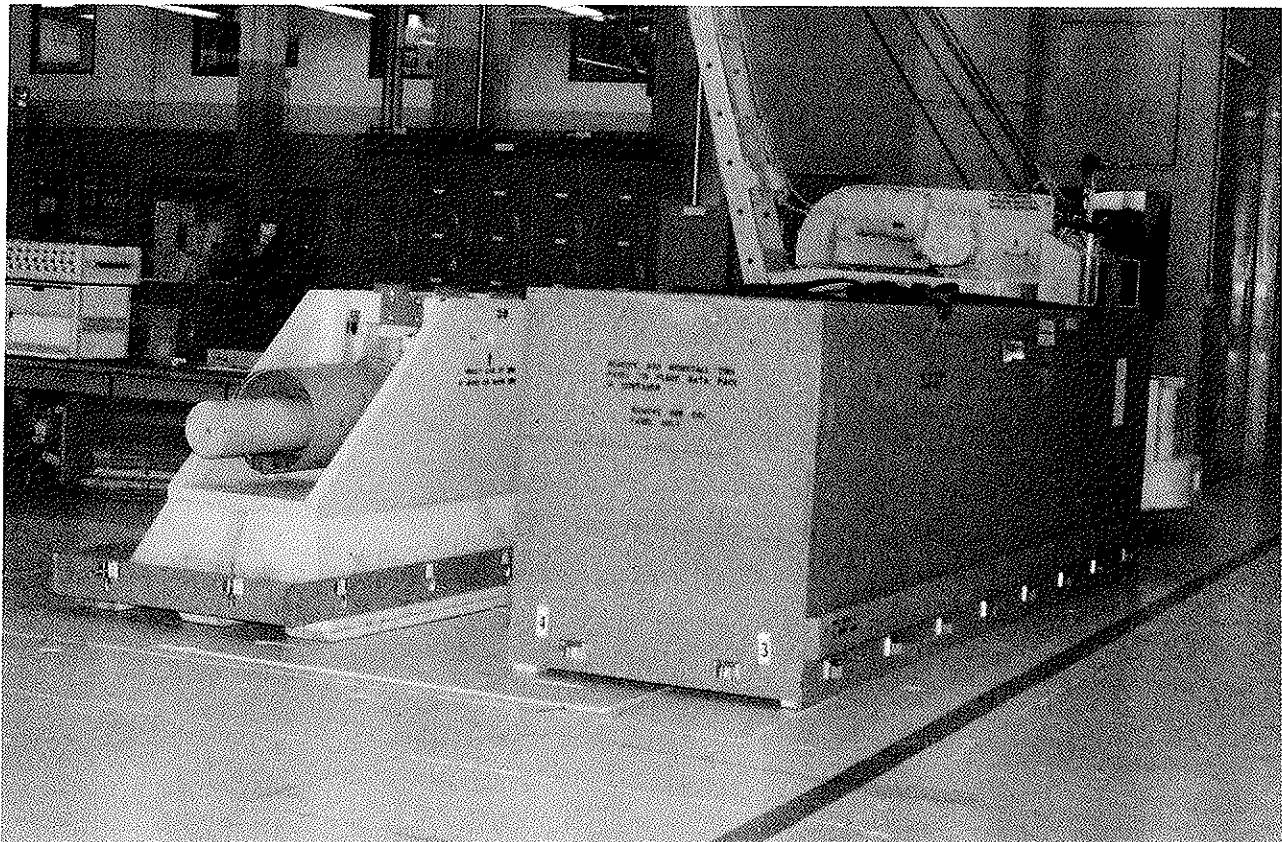
The first option year of the POP contract implemented by this office and Wright-Patterson Contracting Center with WYLE Laboratories of Huntsville, Alabama was exercised. AFPEA submitted approximately fifty sample overpack configurations for testing by WYLE. Following test report approval, the test reports and packaging configuration will be submitted to the Defense Logistics Agency (Richmond) for insertion into the Department of Defense Database.

HQ AFLC/LGTPM, Warren Assink, DSN 787-4519

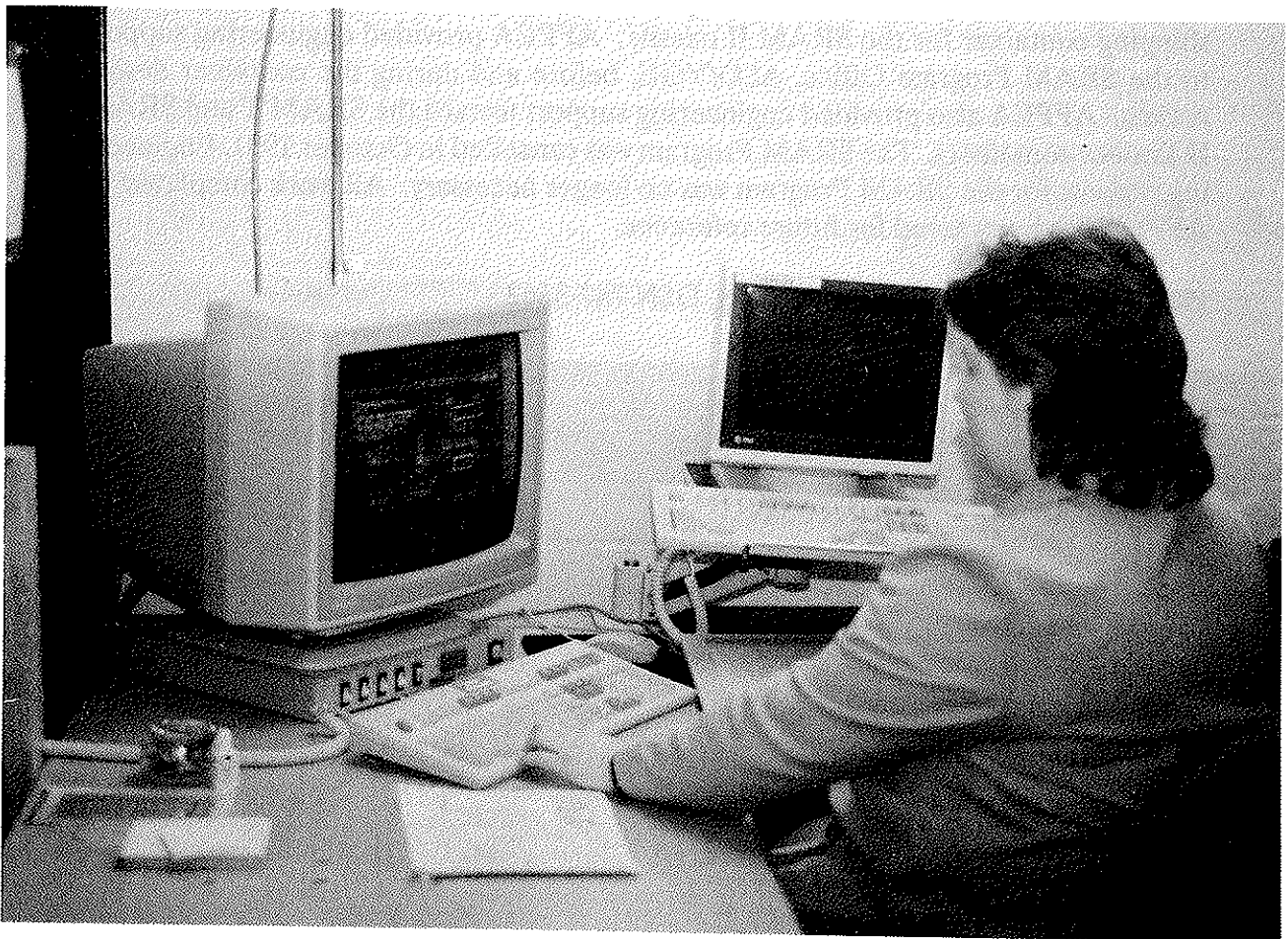
SRAM II/T/TRAINER MISSILE CONTAINER ENGINEERING SUPPORT

The Aeronautical Systems Division (ASD), Packaging Office (ASD/ALXP) requested engineering assistance from the Air Force Packaging Evaluation Activity (AFPEA) in April 1989. Boeing Aerospace is the prime contractor and has designed a wooden shipping container for the SRAM II missile. AFPEA provided engineering support to the SRAM Program Office, ASD/YGE, before and during the container design review. AFPEA also provided engineering support toward the SRAM T and SRAM II Trainer containers. The SRAM Program was cancelled in October 1991. Engineering support for the SRAM Program was no longer necessary. All work completed by AFPEA has been saved for future reference.

HQ AFLC/LGTPD, Robert Tekesky, DSN 787-3362



SRAM II Container with Test Load



COMPUTER-AIDED DESIGN SYSTEM (CADS)

Under the "lead service" concept, Air Force Packaging Evaluation Activity's (AFPEA), Design Branch, provides container design, development, and prototyping services to the Air Force and DOD. The Design Branch CADS workstations consist of seven Unysis 386 PC computers composed of a 20" high resolution color monitor, 340 Mb hard drive, 3.5 high/5.25 low density floppy drives, 8.5x11 programmable digitizer tablet, mouse, and battery backup. Procured late December 1990 off the AF Desktop III contract the systems were complemented with two HP LaserJet III printers and one roll fed HP DraftMaster plotter.

AFPEA Container Design Projects are engineered primarily on the CAD systems through the use of AUTOCAD 386 software integrated to provide additional capabilities. These capabilities range from performing finite element analysis (FEA) of a design as it passes through the developmental stage using Cosmos MFEA software to the actual prototyping of piece-parts on a Sign-Mate 2000/Spindle Cutting System controlled through NC Polaris CAM software.

AFPEA's past addition of an AT&T 3B2/600G Computer System is gradually coming on line to support this Design Engineering Process. The primary function of the 3B2 was to act as a fileserver, storing and managing Special Packaging Instructions (SPIs) received from the ALCs, and the manipulation/storing of complex Engineering Designs. Additional benefits include Electro-Mail (EM) functionality. The individual CADS workstations directly connected to the 3B2 system via thick ethernet can transfer drawing designs to each workstation, spool drawings to the printers or plotters, and can generally store the files on the system. This provides engineering integration to each function performed in the design process without physically requiring the information to be transferred by floppy diskette or other cumbersome methods promoting more effective, efficient service, and support to our customers in the AF and DOD.

From design conception to physical prototyping, AFPEA CADS are working toward quality team support to the AF and DOD.

HQ AFLC/LGTPD, Carey Scott Gravenstine, DSN 787-3362

FAMILY OF ALUMINUM ANTENNA CONTAINERS

A requirement for a Family of Antenna Containers was established at WR-ALC/DST in the early 1980s. A contract was awarded to produce a set of four containers of varying sizes and payload platforms. These shipping and storage containers will house all antennas used by the Air Force. The company, who was awarded the contract, produced fiberglass prototypes which were sent to the Air Force Packaging Evaluation Activity (AFPEA) for qualification testing. The containers could not pass the testing requirements. The company reworked the existing containers and manufactured new ones and none could pass the qualification testing.

AFPEA realized the need for a standardized set of reusable containers and decided to prototype an aluminum container. Aluminum because of its superior qualities, environmental sealing, long life cycle, easier handling of the items and substantial savings in reduced operating and maintenance funds compared to the present wood boxes. These containers can meet all specified requirements submitted by the ALCs. An "A" size (960mm X 960mm X 1100mm) container was designed and prototyped and presented to a group of users at WR-ALC in June 1991 for their comments. At this time the project is on hold until sufficient funding can be obtained to continue the design and testing processes and to produce the containers after the designs are complete.

HQ AFLC/LGTPD, Robbin Miller, DSN 787-3362

MIL-HDBK-304B REVISION

In 1989, AFPEA initiated a revision of MIL-HDBK-304B, the military handbook for package cushion design. The revision includes deletion of obsolete materials and transmissibility curves, revision of text, review of the bibliography, updating of figures, removal of Chapter 5 (MIL-C-26961- Its Ramifications in Cushioning Design) and the addition of a section on electronic pulse filtering. AFPEA based the overall direction for the revision on a survey of MIL-HDBK-304 users. The projected completion date is December 1992.

HQ AFLC/LGTPM, Caroline J. Buckey, DSN 787-4519

TIE-DOWN TESTER

The Air Force Packaging Evaluation Activity (AFPEA) recognized the need for an in-house capability to test the tie-down rings on large containers. We are solving this need with a tie-down tester designed and fabricated in-house. This tester will be able to test up to a 5,000 pound container with restraining a simulated 3G or 15,000 pounds forward force. The tie down tester will be adjustable to test various sizes of containers. Initial operational capability has been stretched out due to higher priority shop work. We hope to have it ready for initial use in the third quarter FY92.

HQ AFLC/LGTPD, James T. Steiger, DSN 787-3362

F15-4 CONFORMAL FUEL TANK (CFT)

At the request of Warner Robins Air Logistics Center (WR-ALC/ DSTD), the Design Branch was asked to provide drawings and a prototype container for the F15-4 CFT. Stemming from the Desert Storm Operation a few additional -4 Fuel Tanks were being procured into the system and requiring containerization on short notice. AFPEA involvement in the past on the F15 Fuel Tank Container led to the modification of drawings and a wooden container designed for the F15-2 fuel tank to meet the design of the -4 Tank but needs fell short and the container has been in storage since that time.

Resurrected to again assist, the container was sent to Seymour Johnson AFB where the first fit was performed. Highlighting changes necessary for the cradle assemblies to function properly the overall container system was a noted success. Returned to AFPEA minor changes were made to the cradle assemblies and noted on the drawings. Due to the short delivery time frame and the cost factors WR-ALC chose to prototype several containers within their own facility. The modified drawing package from AFPEA was provided so it could be converted into the Special Packaging Instruction (SPIs) format used by the "box factory" personnel to build containers. AFPEA additionally provided aluminum templates to assist and expedite in the construction of the cradle assemblies. A secondary functional fit was readily attempted at Seymour Johnson proving the cradle configurations to be a success.

HQ AFLC/LGTPD, Carey Scott Gravenstine, DSN 787-3362

F100-PW-229 ENGINE CONTAINER UPDATE

This is a correction to last year's annual report article where it was stated that fiberglass containers were being used for the F100-PW-229 engine containers. Apparently, the material of the containers was changed from fiberglass to steel. Pratt and Whitney (P&W) is the prime contractor and has developed these containers for the F100-PW-229 engine. These containers include an inlet fan container, core container, low pressure turbine container, and high pressure turbine container.

The steel containers passed qualification testing and are in production. Half of the production order has been delivered to the government and the containers are currently being used in the system.

HQ AFLC/LGTPD, Stacie Smith, DSN 787-3362

FINITE ELEMENT ANALYSIS

The Air Force Packaging Evaluation Activity (AFPEA) utilizes COSMOS/M, a finite element analysis program developed by Structural Research and Analysis Corporation (SRAC). COSMOS/M is a program organized into a system of interrelated modules, which can be either menu or file driven.

COSMOS/M can handle problems with up to 15,000 nodes and 60,000 degrees of freedom. Structures to be examined can be drawn either in Autocad or directly in COSMOS/M. Autocad drawings can be transferred into COSMOS/M where the structure is meshed, constrained and material properties applied. The present version is set up to run on a PC IBM 386/486 or compatible system. The format purchased by AFPEA is able to work problems in linear and nonlinear statics, linear and nonlinear dynamics, advanced dynamic problems and fatigue problems. The program can be easily upgraded to work problems in heat transfer, fluid flow and electromagnetic, capabilities which at the present time there is no need.

AFPEA has and will be benefited greatly by having the capabilities of COSMOS/M. AFPEA can now better their ability to research and design containers, cradle systems or piece parts related to packaging. The whole design can be tested, redesigned and tested again without ever being built. This capability will save valuable fabrication time and money.

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STANDARDIZATION

AFPEA actively participated in the Department of Defense standardization program again in 1991. We acted as Lead Standardization Activity (LSA), custodian, and preparing, user, and reviewer activities. As LSA we managed all documents in within Federal Stock Class 8145. As custodian, reviewer, and user activities we coordinated on 71 documents prepared by other organizations. As preparing activity we revised one military specification (MIL-C-83669). Our average document age of 4.34 years earned us a "satisfactory" rating. In addition we coordinated on three Air Force regulations and Technical Orders.

Our major 1991 standardization acquisition was the Worldwide Standards Service on CD-ROM. This service provided AFPEA additional search and retrieval capabilities for all American Society for Testing and Materials (ASTM) standards.

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PACKAGING EVALUATION TEST EQUIPMENT

The next few pages detail principal equipment of Air Force Packaging Evaluation Activity's (AFPEA) test and evaluation capabilities. The equipment is used extensively to eliminate existing packaging problems and to avoid introducing new problems into the system. Evaluations are made on new containers and materials intended for Air Force/Department of Defense use. (Dimensions are in inches unless otherwise specified.)

TEST FACILITIES/CAPABILITIES AVAILABLE AT AFPEA**1. LOW TEMPERATURE WALK-IN ENVIRONMENTAL CHAMBER:**

TEMPERATURE RANGE: Ambient to 170 to -100 degrees Fahrenheit (F) (ambient to 76 to -72 degrees Celsius (C))

INSIDE DIMENSIONS: 90 width x 182 length x 96 height (229 cm width x 462 cm length x 244 cm height)

DOOR OPENING: 70 width x 82 height (178 cm width x 183 cm height)

DROP TEST CAPACITY INSIDE OF CHAMBER:
4000 pounds (1814 kg)

2. VIBRATION EQUIPMENT:**a. VIBRATION TEST MACHINE (MECHANICAL):**

TABLE SIZE: 98 length x 96 width (249 cm length x 244 cm width)
FREQUENCY RANGE: 0 to 40 Hertz
AMPLITUDE RANGE: .02 to 1.0 Double Amplitude (DA)
MAXIMUM LOAD: 5000 pounds (2268 kg)
MAXIMUM ACCELERATION: 3 Gs peak
FIXTURE SIZE: 127 length x 98 width (323 cm length x 249 cm width)
ENVIRONMENTAL CHAMBER: -40 to +140 degrees F (-40 to 60 degrees C)

b. VIBRATION TEST MACHINE (ELECTROHYDRAULIC):

TABLE SIZE: 48 length x 48 width (122 cm length x 122 cm width)
FREQUENCY RANGE: 1 to 200 Hertz
AMPLITUDE RANGE: 0 to 6 DA
MAXIMUM FORCE RATING: 6000 pounds peak sine (2722 Kg)
ENVIRONMENTAL CHAMBER: -40 to +140 degrees F (-40 to 60 degrees C)

c. VIBRATION TEST MACHINE (ELECTRODYNAMIC):

FREQUENCY RANGE: 5 to 3000 Hertz
AMPLITUDE RANGE: 0 to 1.0 DA
MAXIMUM FORCE RATING: 4000 pounds peak sine (1814 Kg)
FIXTURE SIZE: 25 length x 25 width (64 cm length x 64 cm width)
ENVIRONMENTAL CHAMBER: -40 to +140 degrees F (-40 to 60 degree C)

3. HIGH TEMPERATURE/HUMIDITY WALK-IN ENVIRONMENTAL CHAMBER:

TEMPERATURE RANGE: 35 to 200 degrees F (2 to 92 degrees C)
HUMIDITY RANGE: 50 to 95 percent
INSIDE DIMENSIONS: 99 width x 190 length x 96 height
(251 cm width x 483 cm length x 244 cm height)
DOOR OPENING: 60 width x 84 height (152 cm width x 213 cm height)
DROP TEST CAPACITY INSIDE OF CHAMBER: 4000 pounds (1814 kg)

4. PENDULUM IMPACT TESTER:

CAPACITY: 5000 pounds (2268 kg)
CONTAINER MAXIMUM SIZE: 104 width x 216 length x 144 height
(263 cm width x 549 cm length x 366 cm height)

5. RAIN/SALT-FOG/WIND WALK-IN ENVIRONMENTAL CHAMBER:

TEMPERATURE RANGE: Ambient
RAIN CAPABILITY: 2 or 5 (5 or 13 cm) rain/hour
SALT-FOG CAPABILITY: 5(percent salt solution by weight
WIND VELOCITY: 40 miles per hour (64 km/hour)
INSIDE DIMENSIONS: 76 width x 160 length x 78 height (193 cm width x 432 cm length x 198 cm height)
DOOR OPENING: 62 width x 79 height (157 cm width x 201 cm height)

6. ALTITUDE CHAMBER:

TEMPERATURE RANGE: -100 to 350 degrees F (-73.3 to 177 degrees C)
ALTITUDE: Site Level to 100,000 feet (30,667m)
INSIDE DIMENSIONS: 48 width x 48 length x 48 height (122 cm width x 122 cm length x 122 cm height)

7. THERMAL OVEN:

TEMPERATURE RANGE: +100 to +500 degrees F (+40 to +260 degrees C)
INSIDE DIMENSIONS: 48 width x 117 length x 60 height (122 cm width x 297 cm length x 152 cm height)
DOOR OPENING: 48 width x 60 height (122 cm width x 152 cm height)

8. DYNAMIC CUSHION TESTER:

CUSHION SIZE: 8 x 8 (20 cm x 20 cm)
DROP HEIGHT: 90 maximum (229 cm)
STATIC STRESS RANGE: .065 to 1.6 pounds per square inch
LIFT SYSTEM: Variable speed electric motor
GUIDE BEARINGS: Linear ball and radial ball

9. PROGRAMMABLE SHOCK TESTER:

TABLE SIZE: 24 x 24 (61 cm x 61 cm)
TABLE WEIGHT: 235 pounds (107 Kg)
SPECIMEN WEIGHT: 600 pounds maximum (272 Kg)
LIFT SYSTEM: Hydraulic
GUIDE BEARINGS: Bronze
WAVEFORM LIMITS:
Half sine - 600 Gs at 2 ms
Sawtooth - 100 Gs at 4 ms
Square wave - 200 Gs at 2 ms
Trapezoid - 200 Gs at 5 ms

10. CONTAINER DROP TESTER:

CONTAINER SIZE: 20 x 24 maximum (51 cm x 61 cm)
CONTAINER WEIGHT: 80 pounds maximum (36 Kg)
DROP HEIGHT RANGE: 12 to 84 (30 to 213 cm)

11. XENON ARC, WATER-COOLED, LIGHT-EXPOSURE APPARATUS

LIGHT SOURCE: 3500 Watt Water Cooled Long Arc Xenon Lamp
TEMPERATURE CONTROLS: Automatic, Digital Set Point Black Panel/Dry Bulb
HUMIDITY CONTROLS: Automatic, Digital Set Point Wet Bulb Depression/Condition Water

Meets the requirements for ASTM G-26, Standard Practice for Operating Light-Exposure Apparatus (Xenon Arc Type) with and without water for exposure of nonmetallic materials.

12. UNCON ULTRAVIOLET/CONDENSATION SCREENING DEVICE

TEMPERATURE RANGE: 50 to 95 degree C
LIGHT SOURCE: 8-40 Watt Fluorescent Lamps
SAMPLE SIZE: 26 Holders for Samples Up to 3" x 12" (8 cm x 30 cm)

Meets requirements for ASTM G53, Recommended Practice for Operating Light and Water-Exposure Apparatus, and ASTM D4329, Operating Light and Water-Exposure Apparatus.

13. CONSTANT TEMPERATURE/HUMIDITY CABINET

TEMPERATURE RANGE: 18 to 93 degree C (0 to 200 degree F)
HUMIDITY RANGE: 5% to 99% RH
INNER CHAMBER DIMENSIONS: 26 x 25 x 18

14. ELECTROSTATIC DECAY (ESD) TEST AREA:**a. TEST CHAMBER:**

TEMPERATURE RANGE: Ambient
HUMIDITY RANGE: 8 to 15 percent
DIMENSIONS: 36 length x 24 width x 18 height
(91 cm length x 61 cm width x 46 cm height)
DOOR OPENING: 12 x 12 (30 cm x 30 cm)
CONTROL: Passive and active "Dessicant" systems

b. STATIC DECAY METER:

PEAK CHARGE: $\pm 5\text{Kv}$
DECAY TIMER: 0.01 to 99.99 seconds
SAMPLE SIZE: 3 x 5 (8 cm x 13 cm)
TEST METHOD: Federal Test Method Standard 101C,
Method 4046

c. KEITHLEY ELECTROMETER:

RANGE: 100 ohms full scale to 10^{14} ohms in twenty-five linear 1x and 3x ranges
ACCURACY: ± 3 percent of full scale on 100 to 10^{10} ohm ranges using the largest available multiplier setting; ± 5 percent of full scale on 3 x 10 ohm ranges.

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